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COHESIVE STRENGTH OF ASPHALT.

THE "Philadelphia tests" have developed much discussion as to the merits of the tensile strength tests as applied to asphalts, and asphaltic cements.

In the October number of PAVING AND MUNICIPAL ENGINEERING, my attention was attracted to a statement of Captain Torrey's, viz.: "That tests of cohesive strength have little if any value for determining the relative value of asphalts for paving uses, as all asphalts investigated have more than sufficient strength, and the surplus strength of any asphalt compared with others is probably of no more account than the surplus depth of the sea." How about the ugly cracks which develop in our pavements in the cold weather? Surely if this "surplus strength" were available, the pavement would resist the internal stresses which cause it to crack.

But it is against the first part of Captain Torrey's statement that I wish to record my experience, which has (after using such tests in our laboratory for the past year), pointed out that the tensile strength test, while not conclusive in itself, is one of the quickest and most useful in connection with asphalt investigation.

The Philadelphia and other recorded tests of cohesive strength relate to the strength of mixtures of refined asphalt oil, and sand, such as constitute the asphalt paving mixture. The following results refer to the refined asphalt and asphaltic cement *per se*, as in making the above mixture, and in molding the briquettes a variable is introduced in the manner of molding and the amount of pressure used which often seriously affects the result.

The method employed in this laboratory is exceedingly simple

and very practical; all that is required is a good testing machine such as is used in the cement laboratory, and plenty of broken briquettes of Portland cement. Select those briquettes which are sound, and which have been broken clean across the center and at right angles to the line of stress. Heat the asphalt in an open vessel until fairly fluid, taking care not to overheat the bottom of the vessel too much at any one place. Warm the separate halves of the briquette and stick them together again with the liquid asphalt.

When cold, the briquette may be again broken, and it will almost immediately break clean across the asphalt if the Portland cement is sufficiently strong not to yield of itself. The stress should be applied uniformly, and at the same rate in every test.

The following represents the general results obtained with "Land" and "Lake" Trinidad asphalt, a few of the physical tests being added for comparison:

	"Land pitch."	"Lake pitch."
Softens at	197° F.	178° F.
Flows at	230° F.	188° F.
P. c. of flow	32	100
Tensile strength	331 pds. per sq. in.	519 pds. per sq. in.

The "Lake pitch" above referred to is a good example, but often an exceptional one will run 560 pds.

The "Land pitch" was, of course, slightly harder than the "Lake," but not sufficiently so to affect the result practically, beyond possibly favoring the former slightly.

Asphaltic cements, as prepared by tempering refined asphalt with residuum oil, may be tested in the same way, but here (1) the *hardness* of the cement, as determined by the penetration machine, and (2) the *temperature* at which the breaking is done appear as important factors of the result.

Four briquettes prepared as above, with the best quality of "Lake" cement, and after standing for twenty-four hours, broken, gave the following results: 468, 460, 474, 472 pds. per sq. in. as their cohesive strength, the experiment being conducted with the briquettes at 35° F., the penetration of the cement at 77° F. being 70°.

The following figures show the variation of the above cement with the temperature:

Temperature Fah.	Cohesive strength.
35°	468 pds. per sq. in.
55°	320 " " "
64°	240 " " "
68°	212 " " "

In order to compare the strength of "Land" and "Lake" cement, two samples were obtained of about the same degree of penetration (60° and 56° respectively).

	Tensile strength (average).	
Temp.	"Lake Cement."	"Land Cement."
34°	450	395
57°	368	310
68°	215	215
78°	182	182

The "Lake asphalt" used in making the above cement was not of the best quality, and this may account for the equivalence of the strength for 68° and 78° F.

As an example of the variation of cohesive strengths with the hardness, two Bermudez cements are selected, No. 1 containing 9 of oil to 100 refined asphalt, and No. 2 11 of oil to 100 asphalt.

	No. 1 (penetration 71°).	No. 2 (penetration 87°).
Temp. 38° F.	370 lbs. per sq. in.	320 lbs. per sq. in.
" 60° F.	320 " "	280 " "

I have made comparative tests of Bermudez and Trinidad Lake cements in this manner, keeping the penetration the same in both, and disregarding the effect of the excess of mineral matter in the Trinidad cement; they turned out to be nearly on a par as to strength, although the Bermudez had but one-half the quantity of oil that the Trinidad possessed. By considering the fine impalpable mineral portion of the Trinidad asphalt cement as an integral part of the same which can not be replaced completely by any artificial means, the above comparison will stand. This, however, needs much more elucidation, and the above is stated with some reservation.

A good coal tar will give a fairly high result at first, but this will rapidly fall off after a few days or a week, whereas an asphalt will remain practically constant for a much longer time.

Although the tensile strength test for bituminous cements may not attain the importance which it possesses in the other great

class of engineering cements, yet there seems no reason why such a simple test, guarded by laws founded on careful research, should not be used to advantage. *F. N. Speller, B. A. Sc.*

MR. F. N. SPELLER, for the past three years, has been connected with the city engineer of Toronto, and for the past two years has had charge of the chemical laboratory, instituted through the efforts of Mr. H. D. Ellis, Roadway Engineer. He is an honorary graduate of the School of Science and also holds the post graduate degree in Applied Science with first class honors from Toronto University ('94). During the last two years his attention has been devoted to the asphalt work in Toronto which he has studied with much interest.

BRUSSELS' SEWERAGE SYSTEM.

BRUSSELS, founded in the tenth century, is situated on the river Senne, a tributary of the Schelde. It comprises a lower part of the valley of this river to the north-west and a higher part on the ground which rises gradually to the east and south.

Around the town proper and joined to it are new suburbs, which were formerly villages. They have gradually become towns so closely connected with Brussels that it is impossible for a stranger to distinguish them. Still each of these suburbs has a distinct local authority, a fact which has been the cause of much embarrassment, particularly in sanitary matters.

In accordance with a clause of the laws of 1789 and 1790, which directs contiguous communities to take common measure against epidemics, Brussels and its suburbs make joint arrangements on sanitary matters, especially as to water supply and sewers.

Under its building regulations of 1883 the permission of the communal council is required to dig a well, to repair or abolish a cesspool, to construct a drain or branch drain. Pits, cesspools, soakage wells and drains, before being filled up and abolished, must be thoroughly cleansed to the bottom and disinfected. The council can insist, in addition, on the partial or total demolition of masonry and the carrying away of the earth which has become impregnated with organic matter. During the carrying out of such work the owners must submit to every precautionary measure ordered by the administration to prevent accident or injury to the public health. In repairing or doing away with drains the mud coming from them must be removed without delay; it must not be deposited on the

public road, except temporarily, and then some efficient disinfectant must be used. Wells must be built of special bricks, called "well bricks;" the masonry should rest on a ring of oak or beech at least .08 meters thick, or on a ring of cast iron at least 0.25 meters thick. The walls of wells, reservoirs and any pits used for dung or liquid manure should be independent of walls forming the foundation of buildings, and should be separated from these by an interval of at least 1 decimeter (3.94 inches). Between a well or reservoir and a pit a distance of at least 2 meters should be allowed. The foundation and walls of every pit should have a thickness of at least .28 meters; they are covered within and without with an impervious layer of cement, or of tiles set in cement, and all the angles ought to be rounded off. No cesspool or pit for foul water which permits of soakage into the surrounding soil is allowed.

As to waterclosets and drains, it is laid down that every dwelling house or assembly room should be provided with a sufficient number of waterclosets, having external ventilation by means of a door or window, and otherwise sanitarily arranged. The building of closets for the use in common of several houses can be authorized by the council in cases where it appears impracticable to provide a separate closet for each house. The number of seats should, in all cases, be at least one for every twenty-five inhabitants. Every dwelling house or assembly room should be provided with a system of conduits securing immediate discharge into the public sewers of foul water and of liquid and solid excreta. Every newly-erected house should have a separate drain and should be separately connected with the main sewer. The drains are constructed of stoneware pipes, of bricks, or of other materials sanctioned by the administration. They should be firmly fixed so as to prevent all settling of pipes or separation of joints, and should be perfectly water-tight. The chief drain pipes should have a minimum internal diameter of .225 meters (about 9 inches). They are formed of stoneware of good quality, with a glazed internal surface. The different portions should have good sockets without internal projections; the joints are set in cement, and rendered perfectly water-tight. Brick drains must be built with a very hydraulic cement, and the internal surface covered with a complete and smooth layer of cement. They should be at least .30 meters wide and .36 meters high. Branch

drains should be at least .125 meters (4.9 inches) in diameter, and in the same way as the chief drain. At the point of junction of two drains, the top of the branch drain should not be lower than that of the main drain; the junction should be at an angle of at least 135 deg. Changes in the direction of drains should be by means of curves or bends having at least an angle of 135 deg. Inspection openings should be arranged at points where the possibility of deposits is feared, either within the premises or under the pavement. They must be so constructed as to be both air and water tight.

The sanitary officers determine the position and level of the house-drain with the public sewer. Wherever practicable the level is arranged so that the outlet of the private drains is free, entirely or in part, when the water in the public sewer is at its highest. Generally the junction ought to be made immediately below the origin of the arch of the public sewer, in every case at least .30 meters above the inverted arch of this sewer. The fall of drains should be regular and sufficient. To this end houses should be built at a sufficient height in relation to the level of sewers, or the drains should be raised on supports above the pavement of cellars. In the latter case the administration enforces the measures necessary to secure complete impermeability and to prevent soakage. The pipes for stop-water and fœcal matters and for rain-water of courts and gardens should be at least .10 meters (about 4 in.) in diameter. They are of lead at least .006 meters thick, or of glazed stoneware, and should be constructed so as to be easily accessible for examination and repairs and not embedded in the walls. The junction with the drains are made by means of pipes curved or bent at an angle of at least 135 deg. The overflow pipes from cisterns should discharge into the external air and not be connected directly with the drains. All waste-pipes for foul water and soil-pipes should be trapped as near as possible to their origin. Traps placed in courts and gardens have a water seal smaller than those in the interior of houses. Where, from local circumstances, the outlet of a private drain into the public sewer, or of one public sewer into another, is likely to be occasionally under water, a ventilating pipe should be placed at the upper end of the house-drain. This ventilating pipe should be furnished with a feeble

water seal and open above the roof of the house. A similar ventilating pipe should be fixed in all cases where there are two traps in the course of the same sewer, to be placed below the upper trap. In every building which is not sufficiently high in relation to the public sewers to prevent the flooding of cellars the junction with the sewer should be provided with a flap or cock, or other apparatus, to prevent overflow from the sewers. At the same time rain-water pipes should be so arranged that in case of need they can discharge into the public sewer without passing through the house-drain. Every owner about to erect a new building submits to the administration two plans showing the drainage from the highest story to the junction with the public sewer, with closets, cisterns, wells, pumps, water-taps, traps and other details. After examination, and modification if necessary, one of the plans is returned to the owner, the other being kept by the administration. The administration can require the production of these plans before authorizing any modification in existing buildings. Under special circumstances the assembly of burgomasters and aldermen can authorize or order modification of any of the foregoing requirements.

FIG. 1.

FIG. 2.

As stated already, waterclosets are obligatory in Brussels. There are only a few of the privies formerly in use still remaining. The city furnishes a very instructive example of change of opinion as to water carriage. In many parts of the continent, owing to the prevalent ignorance of the changes undergone by fœcal matter mixed with water, there is still opposition to the introduction of waterclosets. This was also the case in Brussels. In fact, in 1857 a regulation was made forbid-

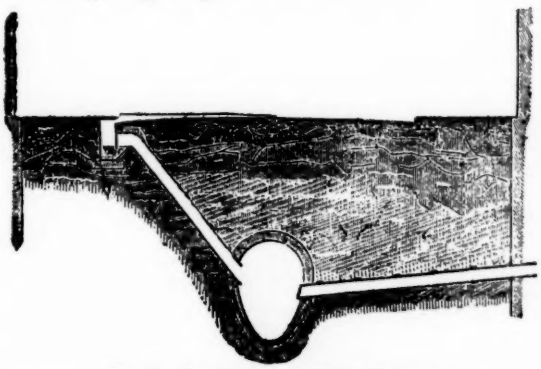


FIG. 3.—SEWER OF THE NEW SYSTEM.

ding their establishment without the special permission of the municipal authority, who would impose the necessary conditions. In 1865 the college of aldermen made a regulation which permitted waterclosets only in the houses of narrow streets and alleys. Since 1883 water carriage has been the only system permitted. The Brussels waterclosets are constructed on an English model, an ordinary form being shown in Fig. 1.

The branches of house drains are mostly of bricks and masonry, egg-shaped, and from .30 to .36 meters in diameter. Others are of glazed earthenware, with a diameter of .25 meters. The traps of kitchens, laundries, courts, etc., usually resemble what is known in England as a dipstone trap (Fig. 2). The dipstone is immersed to the extent of from 2 to 6 centimeters, thus preventing sewer-gases from entering the house.

The sewerage of a town is one of the chief conditions of its salubrity, and has been found to be one of the most difficult and delicate problems for sanitary engineers. The system adopted in Brussels presents some interesting peculiarities and differs considerably from that of England. The sewerage of the Belgian capital was begun in 1847, the first sewers being only intended to receive the waste water from houses. Unfortunately, no general system was adopted and the sewers were constructed without any plan. Sewers having a steep inclination were connected with others nearly horizontal, the arrangement of a street determining exclusively the form and position of a new public sewer. Bad defects soon showed themselves, deposits were formed in the sewers and infective gases of decomposition were evolved. After a heavy fall of rain the chief sewers could not discharge all their water; the lower parts were flooded and foul gases and water entered the houses from the sewers. The subsequent cleansing necessitated much trouble and expense without giving satisfactory results.

FIG. 4.—SEWER OF THE OLD SYSTEM (before 1875).

A commission was appointed to prepare a complete scheme of a new system of sewers. All those constructed since 1875 are part of this new system, and the greater part of the old sewers have been reconstructed.

In adopting the new system the following points have been kept in view—the prevention of stagnation at any point and of the formation of deposits, facilitation of the flow of mud, the entrance of which can not always be avoided, and provision for the free circulation of air.

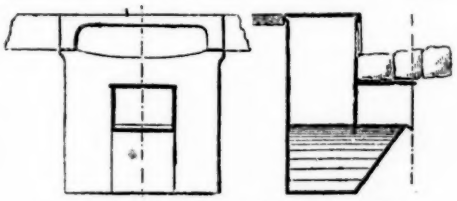


FIG. 5.—GULLY TANK FOR RETAINING MUD.

To obtain these results the sewers do not, as formerly, run in a straight line from below upwards to the highest part of the town, but follow a broken line continued along the streets parallel to the lowest part of the town. In the steepest streets the sewers have a less fall, and in those which are nearly horizontal a greater fall, than that of the streets. In this way the best distribution possible has been made of the available inclinations, and deposits have been avoided by the uniformity of the currents.

All the sewers of the new system have an ovoid form and a height of 2 meters. The masonry is of bricks .18 centimeters thick, rendered smooth within by cement. The sewers are generally placed 4 meters below the surface. Fig. 4 shows one of the great sewers before 1875. In the old sewers catch-pits were placed at intervals, but since 1852 this system has been abandoned. The openings at the side of the pavement for the drainage of rain water are furnished with a trap having a water-seal from 2 to 5 centimeters deep, and a tank for the retention of sand and other solid matters (Fig. 7). In certain parts these openings have gratings, to arrest leaves, straw, etc. Ventilating grids are placed over the sewer, so as to prevent any sewer gases being forced into houses in the event of excessive rain.

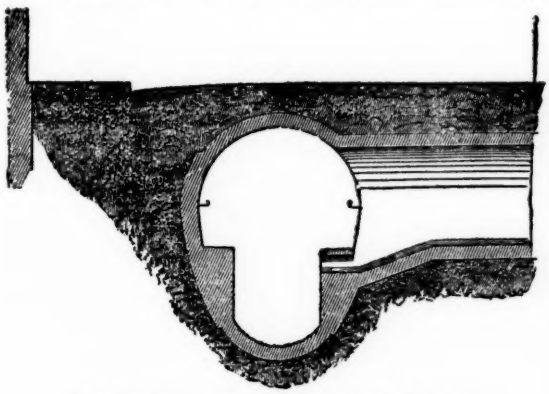


FIG. 6.—COLLECTING SEWER FROM THE RIGHT.

The sewers open into two grand collecting sewers, which run along each bank of the

Senne to the outskirts of the town, where they join together under the crossways of the Avenue de la Reine and the Rue Masui. The collecting sewer from the left bank passes, near the bridge of Masui, under the river to reach the other bank. The two collecting sewers combined are called the great collecting or discharging sewer. This runs parallel to the railroad to Haeran, to the north of Brussels (a distance of five kilometers) where it is discharged into the Senne.

The two collecting sewers are in the form of a cuvette, bounded by a footpath on each side, and covered throughout their length by an arch of sufficient height to allow one to walk freely. The right collecting sewer (Fig. 6) is 1.70 meters wide; the left (Fig. 7) 1.20 meters. The discharging sewer (Fig. 8) is of the same form as the two collecting sewers, but its diameter is 2.20 meters. Until 1867 all the sewers of Brussels opened into the Senne, the banks of which were covered with the houses of the indigent classes. During the dry season this river was practically a vast uncovered sewer with borders of fœtid deposits. When heavy rains occurred, the water rising from the river inundated the sewers in the lower part of the city, overflowed the roads and flooded houses, forced the sewer gases into the interior of dwellings, prevented the escape of sewage, flooded the subsoil, and on retreating left an enormous deposit of mud in the sewers. This happened several times every winter, and in summer also when heavy storms occurred, and sometimes these floods became real inundations and were very disastrous, as in 1850, when the water rose to 2.25 meters above the level of the highway in the lowest parts of the town. When the new system of sewers was introduced measures were taken to remedy the nuisances arising from the Senne. The houses on its banks were demolished; boulevards, squares and wide streets re-

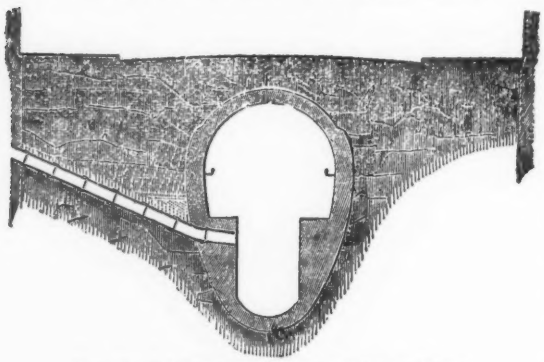


FIG. 7.—COLLECTING SEWER FROM THE LEFT.

placed the narrow and tortuous alleys. The bed of the river was made deeper and straighter from Brussels as far as the confines of the provinces of Brabant and Antwerp, and at the same time it was arched over through the whole of its course under the town, a length of 2,150 meters. Further, the sewers were detached, so as to protect them against the variations in the level of the river. The river is kept between two arches separated by a wall, and the collecting sewers run on each side. Each arch is 6.10 meters wide. The footpaths along the sewers are furnished with iron rails, and on these run trucks of peculiar construction, which are used for cleansing. Rings of iron, placed at intervals of 28 meters, serve for making them fast. Handrails of galvanized iron are fixed in the wall about .9 meters above the footways. At intervals of 50 meters there is, alternately on each of the two footpaths, a man-hole reached by an iron ladder, and at certain important points stairs of easy gradient are substituted for ladders. The connecting sewers running parallel to the river are connected with the latter by openings furnished with valves at their junction with the river. These openings are placed on a level with the footways of the sewer, and are intended to act as overflows during excessive rain. Other openings, connecting the collecting sewer and the Senne, serve to admit water for flushing purposes. These openings are furnished with flaps. The collecting sewers have generally a fall of 30 centimeters to a kilometer, but at a few places the fall is increased to 50 centimeters. The fall being very small, it is necessary to remove the deposits which occur. This is effected by sluice trucks of a peculiar construction (Fig. 9). They are of iron, and consist of a sluice fitted to the curve of the sewer and connected by hinges to a truck placed on four wheels and running on the rails at the edges of the footways. By a single turn of the hand the sluice can be lowered and raised

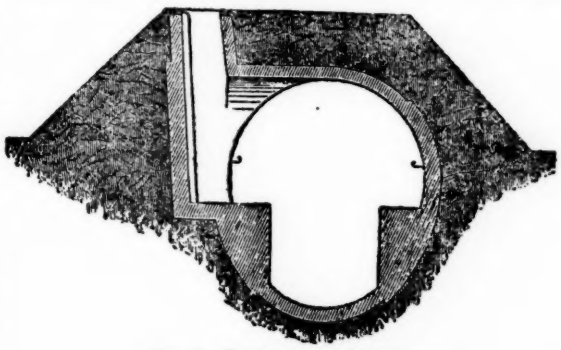


FIG. 8.—DISCHARGING SEWER.

according to need. When it is considerably lowered the water is arrested above, and passing with rapidity under the sluice, urges the truck along, and at the same time carries away all deposits. Some nine trucks of this description, each being worked by two men, are in use for the cleansing of the collecting sewers. The deposits being continually removed can not decompose or produce fœtid gases and the air of the sewer is comparatively pure. Some time was spent in one of the collectors by the members of the Association of Municipal and County Engineers who visited Brussels recently, and we have not heard of the slightest ill effect of the test.

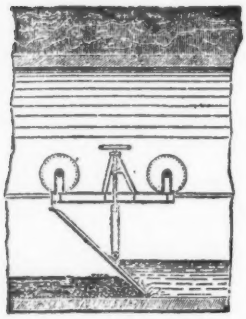


FIG. 9.—WAGON SLUICE.

Since 1872 the question of utilizing the sewage for surface irrigation at Loo and Peuthy, near Vilvorde, where there is suitable land of about 9,885 acres, has been discussed, but the cost of the enterprise was considered so great that we believe it has not yet been resolved to carry it out. For some time past a small part of the sewage has been employed in irrigating about 90 acres near Machelen. The discharging sewer empties into the river at Haeren, 50 centimeters under the water, which consequently rises on to the footpaths at this point, and cleansing of the sewer is impracticable. To obviate this difficulty hydraulic machines have been established at the outfall, and these lower the water at certain intervals sufficiently to enable the wagon-sluices to do their work. This should be done once each week. The hydraulic machines consist of three centrifugal pumps, 1.8 meters in diameter, each worked by a 100 horse-power steam-engine. The cleansing of the collecting sewer employs some twenty men, including those working the pumps. An equal number of men are employed in cleansing the street sewers. The total length of the collecting sewers is 18 kilometers.

Besides the arching in of so much of the Senne as runs through the city, the construction of 17,775 meters of the collectors with rails described above, and certain temporary installations, the works known as "the works of the Senne," and designed for the sanitation of the whole of Brussels and for the prevention of inunda-

tions, include also the demolition of 1,100 of the old houses that fringed the banks of the river, the filling in of what formerly were arms of the Senne, the construction of 5,000 meters of sewers of the 2-meters high type, the reconstruction of various bridges, the removal of various dams and mill weirs, the widening and straightening of the bed of the river, and the cutting of a supplementary bed between the villages of Eppeghem and Sempst. The cost of these works, including the acquisition of the necessary land, amounted to 27,000,000 fr., which does not include special sanitary provision for two or three public buildings nor the cost of surplus land afterwards re-sold for building purposes.

The vaulting in of the Senne and the connected collecting sewers cost on an average 3,500 fr. per meter; which, for collectors that do not follow the course of the river, was increased by 350 fr. per meter in the case of those 1.20 meters wide, 375 fr. for those 1.70 meters wide, and 400 fr. for those 2.20 meters wide. The ordinary egg-shaped street-sewers, 2 meters high, cost on an average 50 fr. per meter, inclusive of all accessory works.

These sanitary works, commenced in 1867, were practically completed in 1874. *Gibson Thompson.*

MR. GIBSON THOMPSON, the author of the foregoing article, is the editor of *The Surveyor and Municipal and County Engineer*, of London.

FLORIDA'S STREET PAVING CLAY.*

THERE occurs near Bartow, Florida, and at other points as far south as Haines City, a deposit which has recently been found to be very valuable as a material for covering the sandy sidewalks and streets of Florida towns. It is popularly known in South Florida by the name "*clay*," but consists essentially of sand, clay and oxide of iron.

ANALYSIS OF STREET PAVING CLAY, BARTOW, FLORIDA.

	PER CENT.
Moisture	4.20
Salica	69.03
Aluminum silicate	18.21
Iron oxide	8.53
Calcium carbonate	Trace.

*From United States Geological Report on Mineral Resources.

The deposit is a sandstone rock, and, although it has to be quarried from its bed, it almost completely disintegrates in the quarrying, and needs no further preparation to fit it for the use to which it is applied. It is of a reddish color, due to the presence of oxide of iron. The material is simply spread over the sidewalk or street to which it is to be applied to the depth of several inches, and then sprinkled with water and rolled with a heavy roller. After being walked upon and driven over a short time it becomes very compact and fully as hard as it is in its native bed.

The most valuable constituent of this material, when used as a covering for roads, is undoubtedly the oxide of iron, which acts as a cement, rendering the material capable of becoming compact and hard. That the iron serves this purpose was verified by removing it from the compound, and subjecting the mixture of the remaining constituents to tests that had been applied to the original material. The adaptation of this deposit to the improvement of roads was first brought to notice by the South Florida and other railroad companies, who used it for the improvement of railroad crossings, driveways about stations, etc., and the first extensive use made of it for streets and sidewalks was by the city of Orlando about a year ago. It has given excellent satisfaction in Orlando, nothing having been done for the place for years that has so much improved it. It has been the means of converting streets so sandy that travel over them was very slow and difficult into driveways over which travel is easy and pleasant. *Robert T. Hill.*

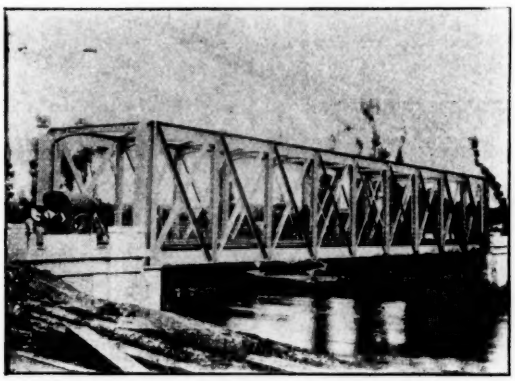
MODERN SPANISH BRIDGE ENGINEERING.

THE writer spent nearly twelve months in España, visiting the state three times. It is a surprise to find, especially in the northeastern parts of the Iberian peninsula, fine and handsome iron bridges springing up everywhere, built entirely with Spanish materials and by Spanish hands. It is largely due to the native bridge engineers organized at Barcelona *(Sociedad de Ingenieros Industriales)* that these results have been accomplished.

The San-Andrés-cross bridge over the river Henares is a bridge which was constructed in 1889. It is solely of one span, 42 meters

40 centimeters in length. The total width is 6 meters. The roadbed has 4½ meters, and the combined width of the two footways is 1½ meters.

The principal iron beams are a lattice-work in the form of a



BRIDGE OF CRUZ-DE-SAN-ANDRES, OVER THE RIVER HENARES, ON THE HIGHWAY FROM AJALVIR TO ESTREMERA.

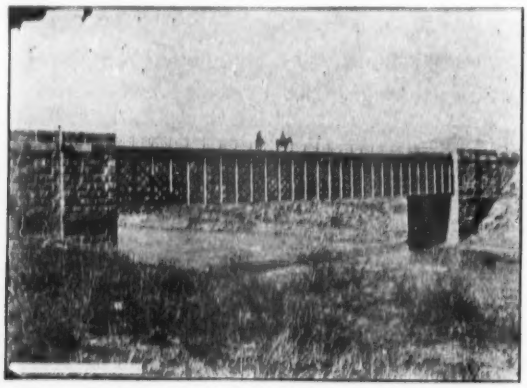
Saint Andrews cross, and there are vertical iron stay-posts. These supports have a height of 6 1-10 meters, and are braced together above. The roadbed is inferior. The cart track is macadamized, sustained by *zorés* irons. The ground-work of the sidewalks is of iron plating, grooved. This is, for España, a very pretty modern bridge.

The writer has tramped afoot over 200 miles of Spanish country roads, but never saw a better looking *puente* than that over the Henares, during a long ramble afoot in the spring of 1891. Some of the rural bridges looked quite 600 years old, and were so worn out—though still used—that even the keystone ridges were half worn through. It was enough to make one hoary looking at them.

The multiple-mail bridge over the river Tajo was constructed in 1880. It is of one sole span, of 52 meters longitude. It has a total width of 6 meters 40 centimeters; 4 meters 40 centimeters of roadbed, and 1 meter each side-path. The principal beams are a lattice of multiple mail-work, and have an altitude of 4 meters 80 centimeters. The roadbed is here the superior part of the bridge.

A forged-iron balustrade protects the walks. The ground-work, both for the road and the paths, is of wood.

This is a specially good example of Iberian bridge engineering.



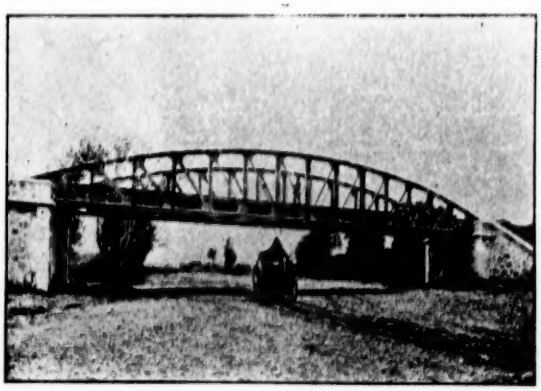
MULTIPLE NET-WORK BRIDGE OVER THE RIVER TAJO, ON THE HIGHWAY FROM TARANCON TO ARMUNA.

It was built, as were all the others, by the *Sociedad Material para Ferrocarriles and Construcciones*, Ancha 2, Barcelona. This is the great railroad supply trust of the Peninsula. The aged M'l Girona is technical director, and he is Barcelona's architectural benefactor. It was Girona, who, out of his own pocket (1,-

BRIDGE OF ALMA-LLENA, OVER THE RIVER FRANCOLI, ON THE HIGHWAY FROM ALCOLEA-DEL-PINAR TO TARRAGONA.

000,000 pesetas—$200,000), restored to a type of beauty, the city's hoary cathedral pile, converting it into another Milano, on a small scale.

The Alma-Llena bridge, over the river Francoli, was constructed in 1879. It has five solitary spans, of 27 meters each. It is 10 meters 60 centimeters wide—that is to say, 6 meters 20 centimeters for the roadway, and two sidewalks of 2 meters 20 centimeters. The principal beams or supports are of solid columns, 4 meters 20 centimeters in height. The walks are "winged" (projecting beyond the supports), and have a balustrade of forged iron—which design is distinguished in the illustration. The roadbed—both of the cart-track and two footpaths—is of macadam, sustained by buckled plates.

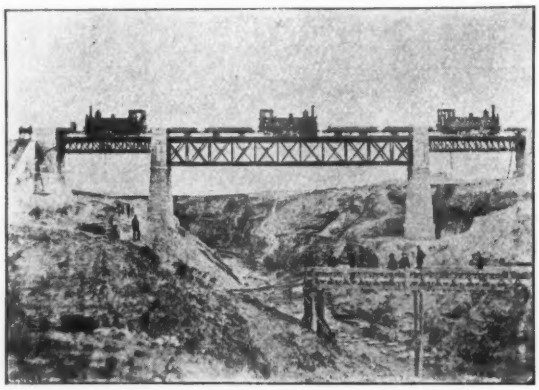


PARABOLIC BRIDGE OVER THE RIVER-BED VILAMAJOR, ON THE HIGHWAY FROM LLINAS TO SAN-CELONI.
[In summer and in the fall the dried-up river-bed is used for cart-traffic.]

The parabolic bridge over the river-bed of Vilamajor was constructed in 1883. Length, 29 meters—one span; width, 5 meters, being 3 meters 70 centimeters for the road, and 65 centimeters for each sidewalk. The principal supporting beams are parabolic, and the crosspieces take the form of N. They are 3 meters 30 centimeters in height at the center. The roadway, which is on the lower part of the bridge, is a compact stone road, sustained by small vaulted brickwork supported on the transversal beams. The floor of the sidewalk is of wood.

The waterway, like many others in España, is completely dry during a good part of the year; but at times there are strong and copious floods, in which case it is of necessity to have a strong bridge over the waterway.

Of the cross-bridge of San-Andrés over the Tio Vinalapó, the date of construction was 1884. It is of three independent spans: one, central, of 30 meters longitude, and two laterals of 12¼ meters each one. This bridge is for a narrow-gauge railroad (1 meter between rails). It has 2 meters' width between the centers of the principal beams, and moreover a little "winged" walk, of 50 centimeters' width, to each side. The leading stays are of iron, having the form of a cross of St. Andrew, and with vertical joists. Those of the central span are 3 meters high, and those of the lateral spans are 1½ meters. The track is superior. The rails are laid on iron jamb-



NATIVE BUILT ENGINES AND CARS ON THE BRIDGE OF CRUZ-DE-SAN ANDRES OVER THE RIVER VINALAPO, ON THE ECONOMIC RAILROAD FROM VILLENA TO ALCOY.

posts, fixed to the transversal beams. The narrow foot-ledges have a wood flooring.

In the photograph taken of this bridge may be seen various locomotives and wagons occupying completely the three spans. This represents the act of verifying one of the proofs to which this bridge was submitted.

All of these bridges are of laminated iron, and are constructed according to the European system of rigid joinery, obtained by means of sufficient riveting. In all these bridges there is no forged work, so that the bars of iron, once out of the hands of the laminator, solely necessitate the labor of cutting, perforating, and riveting.

The three bridges anteriorly mentioned are calculated for resist-

ing, in addition to the permanent load, two classes of overloads, as is prescribed in the regulations of bridges for the cart tracks of España. One of the proof-loads is the *estatica* (science of weighing bodies), the estimation being 300 kilos—660 pounds per square meter. The other test is known as the *rodada*, or rolling proof, produced by carts, which fill the bridge, each one of a weight of nine tons when of two wheels, and of twelve tons when they are tilt carts of four wheels. In the bridge over the river Henares, the framings, because they are of great length, are formed by bars composed of two angle irons, and a sole of plane iron some in form of a ⊥, while others are in the form of ⌙, with the object of obtaining sufficient rigidity, or transversal resistance. *W'r Lodia.*

ESSENTIAL QUALITIES OF PAVING BRICK.*

The writer has seen no specifications for brick pavements which either clearly or fairly describe the material to be used, so that the manufacturers or bidders can know just what will be required upon a given work. The majority of the specifications recite that "the brick to be used must be hard, free from defects of any kind, manufactured and burned especially for street paving purposes, be equal in all respects to the sample filed with the proposal, and subject to inspection and acceptance or rejection by the engineer or inspector." With our present knowledge of this material, this phraseology may be accepted, but in reality it specifies very little. Its acceptance or rejection by an engineer is ordinarily regarded by the corporation as a safeguard, but no parties entering into a contract can place a power that is wholly arbitrary and undefined in the hands of an engineer, who is in reality the executive agent of one of the parties. Because bricks have been manufactured and burned especially for street paving purposes, does not necessarily fit them for such use; the term *hard* is an indefinite one, and without stating what constitutes defects, there may be differences of opinion as to whether or not they exist in a given article as well as to the *equality* of goods furnished with sample exhibited. Even sample paving bricks have been known to be worthless for street paving. The characteristic

*From the *British Clay-Worker*, London, October, 1894.

qualities and strength of the material are not clearly set forth as they should be. The power to accept or reject is left undefined, which should never be the case; neither manufacturer, bidder, nor tax-payer should be bound by the action of an engineer, unless that action shall be in accordance with known provisions and fixed rules. With the hope, therefore, of adding something to the information needed for bettering specifications in this respect, let us examine our work.

There are such wide variations in clays that it will probably be advisable not to be too definite in specifying ingredients. Silica may constitute from sixty to seventy-five per cent.; alumina, from fifteen to twenty-five; iron, from five to ten; while lime and magnesia should neither exceed two per cent.; and the alkalis should be from one to two per cent. The form and proportions in which these ingredients are present, and the difference in results obtainable by variations in methods of manufacture are so great, that it will evidently be better to define the qualities which are required, and leave the manufacturer free to produce them in his own way. Lime can be readily detected, and an excess of that ingredient might properly be prohibited by the specification.

With suitable ingredients, properly combined and burned, the percentage of absorption will be small. It varies greatly, indicating a lack of uniformity in results, which is to be avoided, or failure will result. The absorption should, therefore, be placed at the lowest limit which can be designated without excluding such bricks as are known to have withstood other tests creditably. I would recommend naming two per cent. as the maximum.

Specific gravity depends to some extent on the density of the material, and should, therefore, be as high as is obtainable with this material. Two and one-tenth might be named as a minimum, with credit for excess, as about two and three-tenths is attainable.

The crushing strength determined from two-inch cube should not be less than 12,000 pounds per square inch. This might be named as the average crushing strength, the limit of variation of any sample not to exceed twenty-five per cent. below.

The nodules of rupture, as determined by tests of transverse strength, could properly be fixed at 1,600.

Unless a rather liberal allowance be made in the matter of abrasion, as compared with granite, manufacturers may complain that many are called but few are chosen. One-third of the competitors in this test would be among the selected by placing the limit at two and two-tenths times. It will be safe, therefore, to say that in any tests for determining the comparative loss of the brick under abrasion and impact, as compared with Lithonia granite, the loss in weight of the brick shall not be more than two and one-fourth times that of the granite.

Uniformity in size and texture appears to be attainable, and lack of it produces many undesirable difficulties. Wide variations in size result from faulty drying and burning. We must either specify how the drying of the brick and the firing of the kiln shall be done, or describe what we want as the product of the kiln, and insist upon getting it. In the present state of our knowledge, the safer plan will be to name the requirements and leave the manufacturer to wrestle with the details.

The amount of percentage of contraction in drying and burning varies with the different clays from one to twelve per cent. With the coal measure fire-clays it is usually about two or three per cent., while with the plastic clays and river silt it is very much greater. Excessive contraction is obviated to some extent by adding to the mixture, ground burnt clay and a fusible sand. Unless other ingredients are present to obviate such a result, these components are liable to produce brittleness. In modern down-draught kilns with clays which do, and should contract as much as three per cent., rapid firing sometimes produces bricks from the upper courses, on which the flame acts directly, that are actually larger than the moulds in which they have been formed. It follows that such bricks are much checked and cracked, rendering them unfit for use, but the cause is apparent. The contained moisture in the partially dried brick is expanded by being first turned into steam, and, while in this condition, the outside of the brick is fused, thus permanently fixing its exterior form and dimensions, except as modified by checks and fire cracks. Other bricks in the kiln, made in the same molds, will be shrunken to the full extent of their contractility, thus producing not only a troublesome variation in size, but likewise wide differences in quality. These defects can be remedied

by a gradual and continuous firing that will produce and permit the natural amount of contraction throughout the kiln. Absolute uniformity in size is not practically attainable, but a much nearer approach to it than is now common can be reached by specifying a minimum allowable deviation and rejecting material that does not comply with the requirement. I would suggest two per cent. as the maximum allowable variation from the standard dimensions adopted.

Assuming that the clay has been properly ground and mixed, uniformity in texture is obtainable only by conducting the burning in a suitable manner, continuing it to a sufficient degree, and no longer, and then allowing the kiln to cool down without permitting draughts of cold air to come in contact with the bricks until their temperature has fallen below the boiling point of water. The degree to which the firing should be extended is ordinarily termed "complete vitrification," but would appear to the writer to have been very unhappily chosen. To "vitrify" is ordinarily held to signify "turning into glass by the action of heat," which is not the desired result in this case. The term having been adopted by common consent, the meaning of which defines the process must be given it, and would appear to be, that the alkalies and alkaline earths shall form vitreous compounds with the iron, and more readily fusible silica, so as to give the brick a dense, uniform texture, obliterating the granular appearance completely, but not fusing or melting the brick so as to injure its form or exterior. This result is obtainable only by progressive firing to the right extent, but with the manufacturer it is like Major Jones's exercises, the fine point consists in knowing just where to stop. In this particular feature the fire-clays are claimed to be superior to the shales and silts. The latter are more readily fused than the former, and when the melting point is reached, the bricks sometimes lose their form and melt together. To avoid danger from this source, sudden cooling is resorted to, and the product is rendered practically worthless by the brittleness which results from such a course. It is claimed that the fire-clays can be held at a sufficiently high temperature to produce the required "vitrification" without danger of melting together, and hence furnish the most reliable product for street paving purposes. Our investigations appear to point to the conclusion,

that from neither clay has that uniformity of product been attained which is desirable, and that can and must be made before reasonable certainty in strength and durability can be assured; for among the fire-clay bricks many are found that show scarcely any indications of fusion or "vitrification" at all. Many more that are but partially fused or "vitrified," the exterior portion being dense and non-absorbent, while the interior, marked by concentric colored rings, surrounds a central portion of open granular texture, and still others present a closed metallic or granitic texture throughout. By firing and annealing in a proper manner uniformity in texture without brittleness can be produced from any clay that is suitable for the manufacture of bricks for street paving. These qualities should be specified, and such manufacturers as can not and do not produce them should not find sale for their goods, because the hopeful young industry will soon perish, or be relegated to the smaller interior cities and towns, unless these essential qualities are produced. It may be asserted that such requirements will increase the cost of production. If need be, let it be so; but such as furnish the required product will find a continued and increasing demand for their goods, giving a permanent value to the plant, and the only additional expense necessarily involved would appear to be more time and care devoted to the burning and cooling.

CURRENT INFORMATION.

AN ABSURD LAW IN NEW YORK.

The interpretation, by Commissioner of Public Works Michael T. Daly, of Assemblyman Tobin's bill, which became a law during the last session of the state legislature, has caused consternation among the granite-paving contractors of New York city. A communication from Commissioner Daly to a contractor, dated September 28, 1894, says:

"You are hereby notified that, according to an opinion given me in writing, by the counsel for the corporation, in relation to the application of the act, chapter 277, of the laws of 1894, all stone used under contracts for municipal works and improvements, including all contracts now in existence, as well as those hereafter to be made, must be worked, dressed or carved upon the ground where the work is being carried on, or within the boundaries of the city of New York, and that this provision includes chiseled and dressed stone for buildings, for basin heads, crosswalks, curb flagging, paving blocks and all kinds of stone which require dressing or working to any size, dimension or shape. You are therefore notified that all such stone which may be used or placed under your existing contract for paving from and after this date must be dressed and worked upon the ground where the work is carried on, or within the boundaries of the city of New York, and that any failure on your part to comply with this notice will impose upon me the duty of revoking your contract."

The bill is thought to have been passed in behalf of the local granite cutters, and was prepared by persons ignorant of the consequences that would result from it. The results are, that the market of the state of New York will be closed to the products of the labor of more than 6,000 granite block cutters and helpers in the quarries of the New England states; nearly 4,000 pavers and rammers throughout the state, a large proportion of them residing in New York city and Brooklyn, will be thrown out of employment, owing to lack of materials with which to work.

The cost of bringing granite on in the rough and bulk from the quarries would be enormous, owing to the waste and to the need for contractors to rent additional yards. The cost of granite paving is about one-third lower than that of asphalt, but contractors say that under the Tobin's act it will cost about double the price of asphalt. The contractors propose to fight the law.

A PLAN FOR PAYING FOR STREET PAVING.

A special committee of the New Haven, Conn., common council, composed of Henry T. Blake, Albert B. Hill, Herbert C. Warren, L. H. Johnson and John H. Leeds, in a recent report, recommended that street paving be paid for by the issuance of bonds by the municipality covering one-third of the cost, the remaining two-thirds to be assessed against the abutting property. It is proposed to divide the assessment on abutting property into ten annual installments.

The advantages of this plan, the committee says, is that after a proper system of street paving has been decided upon, it provides a way for paying the cost in an easy manner. It is also believed that after said pavements are laid enough will be saved from what is now spent yearly for repairing our streets, to more than pay the interest on the outstanding bonds; and the collecting of the assessments by yearly installments provides an easy way of retiring the principal of said bonds. The foregoing plan has been in operation in many of the large cities of Ohio with very satisfactory results, especially in the city of Columbus, where there have been issued during the past four years something over $4,000,000 of bonds, one-third of which have already been retired, and the city of Columbus is said to be one of the best paved cities of the United States.

HOW TO MAKE MUNICIPAL BONDS VALUABLE.

F. M. Stafford, of Chattanooga, offers the following suggestions regarding the issuance of municipal bonds:

1. New York is the financial center of this country. Nine-tenths of the investors live in the North and insist that principal and interest be payable in that city; therefore, make New York the place of payment for both principal and interest.

2. Make interest payable semi-annually and not annually.

3. Make the denominations $500 and $1,000, and in no instance less than $250. Issues of denominations of $100 are almost entirely unsalable.

4. If it can be prevented, do not make your bonds optional. If it be desired to pay in small amounts and yearly, make the payments fall due that way, one or more bonds maturing each or every other year, as you may wish.

5. In order that a bond be valid or legally binding upon the municipality issuing it, it is of *primary* importance that the law authorizing the borrowing of money and the issuing of bonds to evidence the debt *clearly grants* the power to incur the indebtedness. This power once shown goes far towards establishing the validity of the issue, but as no one will knowingly buy into a law suit, be extremely vigilant that every step preparatory to issue, even to seemingly trivial details, be in exact accordance to law.

6. Do not make the rate of interest too low. It will not accomplish the object desired, as this is governed by circumstances beyond the control of any one. Only cities of the larger class with most favorable financial statements can borrow money at less than six per cent.

7. A bond payable in gold coin always finds a quicker and higher market than one not so expressed.

8. The actual valuation of property in a city, town, or county, is the estimated sum for which it can be sold. The assessed valuation (which furnishes a basis for debt comparison and will average in the South about 50 per cent. actual valuation), is the entire amount of taxable property therein, which item represents its resources. The ratio between this amount and its bonded and floating indebtedness is a sufficient guide, other features being favorable, to enable a buyer to decide as to the ability of a municipality to pay its debt.

9. It is well not to complete the physical part of your bonds, but leave blanks to be furnished by the

purchaser. Time and money are oftentimes saved thereby.

10. *The mode of offering bonds is extremely important.* Issues, excellent in every respect, are often rendered unsalable by indiscriminate and generally unauthorized offering. Do not allow your bonds to be "hawked" about by every peddler, but place them *exclusively* in the hands of a competent agent. Issues are often injured by advertisement and subsequent non-successful attempt at sale. Bonds having undergone this treatment are harder to sell and generally bring less price than in cases where no attempt at sale has been made.

MUNICIPAL REFORM IN MICHIGAN.

An outline of the plans of the commission, appointed by Michigan's legislature to consider reform in the municipal charter system of the state, shows four classes of cities, which, alone, differs considerably from the costly, elaborate system now in vogue in that state. Detroit, with 250,000 population, comes under the first class; Grand Rapids, 84,000, under the second class; cities of 10,000 or more, third class; cities and villages under 10,000, fourth class. The new plan limits aldermanic power and increases the mayor's authority. The departments of city government are indicated, with the privilege of appointing boards for each department, which boards execute legislation enacted by the city council. These boards are not subject to interference in the letting of contracts or other executive work. Responsibility for proper administration is centralized so thoroughly, that all can recognize readily to whom is due credit for good work, and who is the author of any given wrong. Provisions are made for the municipal ownership of lighting, transportation and water-works plants, a maximum rate of taxation, and a distinct adherence to the principle of local self-government.

CO-OPERATIVE CONTRACTING IN MONTANA.

A co-operative contracting company has been formed at Butte, Mont., by sixteen men, who, for some time, had been without work. By close bidding, they secured a contract for sewer construction, in which they are sure to earn $3 per day, each. Whatever the profit may be, however, it will be divided equally between the men. Although one man was elected foreman, he ranks no higher than the other laborers and receives the same compensation that the rest of the number receive. They work eight hours per day.

IMPROVEMENT OF STREETS IN SAN FRANCISCO.

The Merchants' Association at San Francisco is making progress in its effort to improve the condition of the streets. Interest is manifested by the property owners and the outlook for the work is encouraging. The preliminary steps have been taken for improving Bush street and Van Ness avenue. It has been found that it will cost but 14¾ cents per square foot to put down a bitumen pavement on a concrete foundation on Van Ness avenue.

MONEY WITHHELD FROM CHICAGO CONTRACTORS.

An attempt was made recently by contractors, at Chicago, to collect the reserve money due them for paving done during the years 1891–92. As it has been the custom for years for the city to retain

a portion of the money due for such work until the time of the agreement, and keep the work in repair has expired, the contractors for these streets still had money coming to them. The time of agreement on granite pavements is five years, and on cedar block pavements three years. If, during the time the contractor guarantees to keep the streets in good repair, he fails to do so, the city may do it, and pay for the work out of the reserve of the contractor's money. During his administration, Mayor Carter Harrison began an investigation of the pavements laid during 1891–92. Six special expert inspectors were appointed by the mayor to aid the superintendents. The report of the inspectors showed that 682 streets were not laid according to specifications, and that to place the streets in the condition required of the contractors when they turned them over to the city, would involve an expenditure of $240,000. The reserve fund was $61,068. Mayor Hopkins has refused to allow this money to be paid over to the contractors, and advised them to seek recourse in the courts if they have been wronged.

TEST OF KANSAS PAVING BRICK.

The result of the city's test of paving material for Delaware street, Leavenworth, Kan., was as follows:

	Breaking. lbs.	Crushing. lbs.	Abrasion. p'c't loss	Absorption.
1. St. Joseph.....	3,860	11,760	4	1.49
2. Soldiers' Home..	2,940	8,790	179-10	.74
3. Atchison.....	4,070	21,060	41-10	.43
4. Moberly.....	3,3 0	15,360	41-10	2.79
5. Kansas City.....	2,770	13,300	31-10	2.92

The brick manufactured by John Gaffney, Atchison, Kan., was selected, as its showing in the test far surpassed the other makes.

COST OF SEWER PIPE IN BROOKLYN.

During the last month the two manufacturers of cement pipe in Brooklyn have advanced their prices 66 per cent. This has led to a public demand that the salt glazed vitrified pipe manufacturers in the middle states shall be admitted to competition to Brooklyn, and it is claimed that if this had been done over $20,000 would have been saved in contracts awarded during October.

SOME OF THE DIFFICULTIES OF ENGINEERING.

In discussing the subject of slopes in the brick pavements on a number of the streets in Burlington, Ia., City Engineer William Steyh recently said:

"Nobody regrets the existence of sloping pavements in this city more than I, but unfortunately the necessity for bearing with them exists. When we talk of paving a street it is easy to see how it could be done exactly right, and according to all our theories of correct streets. But when we undertake to do the work, then conditions confront us, and the theories have very little more to do with the case. It is a question of how to get the street paved and suit the abutting property-owner and keep the city out of an injunction lawsuit. For instance, take the slope at the south side of Jefferson street. Here was an old street, with the grades established, property valuable, and the buildings occupied by business. If I had carried that job through as it should have been done I would have raised the grade on the south side of the street and caused the abutting owners to build retaining walls, which would have placed their property below grade and injured its usefulness. The city

would have had an injunction suit on its hands before a spade was turned. Besides, there were several widows interested, and what man is going to deliberately cause loss or injury in cases of that kind? We simply had to do the best we could, as we have to do in all cases where paving is to be done on old established grades and on hills where the street intersections often complicate matters so that it is necessary to choose between several evils.

"Many people who know nothing of the engineering business will harshly criticise, without pausing to think or look at a matter in its different lights. It is simply impossible to pave an old city, where grades have been long established and property improved, and do justice in any satisfactory degree to the public, the property-owner or to the science of engineering. And so, we simply are obliged to go ahead and do the best we can, choosing what we believe to be the least of the evils that confront us at nearly every turn."

THE YOSEMITE NATIONAL PARK.

A report has been submitted to the secretary of the interior, by Captain H. G. Gale, of the Fourth Cavalry, acting superintendent of the Yosemite National Park, California. He says that there are many misunderstandings, owing to private ownership of land in the park. It would be wise, he believes, for the government to purchase the timber land in the park, and thinks it would be advisable for a commission to be appointed to appraise all land owned by private parties and learn if it could be secured. Game in the park is on the increase and larger wild animals make their presence felt. Forest fires have not been of any magnitude. He thinks the droppings from the trees should be burned every year, because, if allowed to accumulate, it would be disastrous. The report recommends a reduction in the size of the park by withdrawing the mining and agricultural lands and advocates the adoption of natural instead of artificial boundary lines. The reduction in size would throw out about twenty townships and leave the balance of the park almost wholly in possession of the government. Captain James Parker, of the Fourth Cavalry, acting superintendent of the Sequoia and General Grant national parks, reports to Secretary Smith the condition of these national reservations, showing what has been done in protecting them. He says that there are great demands by the sheep men for pasturage on these reservations. He considers the policy of making forest reservations a good one and suggests the extension of these national parks to include the land between the forest reserves and the parks and also to take in a portion of the forest reserves. More roads are needed in the parks.

NEW ORLEANS' FIRST VITRIFIED BRICK PAVEMENT.

The first vitrified brick pavement ever laid in New Orleans, has just been completed. It has been laid in Clinton street, just back of the custom-house, and extending from the custom-house to Bienville. Heavy traffic in the sugar trade prevails here, and the street, which was formerly paved with cobblestones, had become greatly worn, and out of repair. The surface is now smooth, and the entire curve from curb to curb is described as being "as regular as the deck of a ship." The cost of the pavement was $2.85 per square yard.

WITHHOLDING INFORMATION FROM CONTRACTORS.

A motion was recently introduced at a meeting of the city council, at Houston, Tex., that expressions on the pavement question from property owners, be referred to the board of public works, and not read in open council. The idea of this motion is to keep the contractors in ignorance of how the majority have expressed themselves.

A CLAY CURBSTONE IN GERMANY.

In Germany, a mixture for the manufacture of clay curbstone, gutters, drains, etc., consists of the following: Clay, 91½ parts; iron fillings, 3 parts; common salt, 2 parts; potash, 1½ parts; ash of elder or willow wood, 2 parts. Directions for coloring the mass are, violet-brown color, two parts of pyrolusite to 100 parts of the mass; violet, one part of pyrolusite; green, one part of copper scales; blue, one part of oxide of cobalt; yellow, two parts of oxide of antimony.

NEW YORK'S WOODEN WATER PIPES.

New York's first water system was constructed a century ago. Most of the pipes were made from red cedar logs, varying in length from eight to ten feet and in diameter from ten to fourteen inches, and with a three-inch channel through the center. Each section was pointed at one end so that it could be driven into the opening of the square end of the next section. The cedar pipes, some of which were recently taken up, are apparently in as good condition as when first put in the ground, but those of pine and other woods are not well preserved. The center from which the different lines of wooden pipes radiated is at the corner of Center and Duane streets, and here stands the reservoir that supplied them with water. The depth at which the pipes were found varies from three to five feet. A water gate was also found at Water street and Maiden Lane, which is an oval piece of flat iron, eighteen inches long and six inches wide, squared at one end, where it is pierced with a right angled opening an inch in diameter. The gate, when found, was inserted in a slot in one of the pipes and so adjusted as to close the water way in the pipe when pushed to the bottom of the slot. It is believed that originally it had a handle fastened in the square opening to operate it with. A building was built around the old reservoir belonging to this system before the middle of the century.

NEW PUBLICATIONS.

The prevailing theories and practices relating to sewage disposal are discussed by Wynkoop Kiersted, C. E., in a volume of 175 pages, published by John Wiley & Sons, New York. The discussion deals with principles rather than mechanical methods in the treatment of sewage. "We have in nature," the author says, "conclusive evidence of the existence of a natural process of purification of polluted waters. The process is of such a character that it can be utilized in the purification of sewage, and with our present methods of sewerage and drainage, it must become the foundation of any successful method of sewage disposal." The author's aim is to set forth this natural process of purification "together with the various considerations embraced in questions of sewage disposal in a simple and practical manner."

The seventh annual report of the

street and sewer department of Wilmington, Del., for the last fiscal year, shows that street paving was done as follows: Granite block, 26,061 square yards; rubble stone, 10,805; vitrified brick, 2,411; macadam, 36,902; telford, 18,269; total cost $97,894. Street grading embraced 17,349 cubic yards, and curbed sidewalks, 6,636 lineal feet. The engineer in charge is T. Chalkley Hatton, and his assistants were Theo. A. Leisen, James C. Melm and Geo. H. Baughman.

Coal is a manual which has been compiled by J. Stockley Cary, chemist, and T. P. Richey, of Chicago. It is their aim in presenting it to the public, to give to miners, dealers and consumers of coal, a convenient pocket edition of helpful and general information which will prove of beneficial and practical use to them in their daily work. It is published by J. S. Cary, 1760 Monadnock Building, Chicago.

The Van Denbergh Laboratory of Chemical Industry, Buffalo, N. Y., has issued its autumn calendar, on which appears an interesting and descriptive illustration of Niagara Falls and its power and the Pitch Lake of Trinidad.

The report of Commissioner Daly, of New York City, shows that the expenditures from the different funds, for the quarter which ended June 30, 1894, were as follows: Appropriation account, $765,671.24; street improvement fund, $355,-916.21; Croton water fund, $196,-139.39; re-pavement fund, $210,-714.51; miscellaneous funds, $183,-684.65—total, $1,712,126. There were laid 22,796 square yards of new granite block pavement, and 43,014 square yards of asphalt pavement. Manhattan Island now has 379.61 miles of paved streets, and 458.51 miles of sewers.

LEGAL DECISIONS.

[Reported for PAVING AND MUNICIPAL ENGINEERING.]

Validity of Ordinance for Paving of City Street.—An ordinance providing for the paving of a street, to be paid for by a special assessment, is not void because it does not provide for man-holes and catch-basins to convey away the surface water. Vane *v.* City of Evanston, 37 N. E. Rep. 901.

Validity of Service on Non-Resident for Enforcement of Municipal Liens.—Act 1881 authorizing service in actions to enforce municipal liens on property owned by non-residents by posting a copy on the premises and by publication, is constitutional. City of Philadelphia *v.* Jenkins (Supreme Court of Pennsylvania), 29 At. Rep. 794.

Validity of Assessments for Street Improvements.—Where the statute provides that the expense of street work "shall be assessed upon the lots and lands fronting thereon, and except as hereinafter specifically provided." Subdivision 8 provides that, where any work mentioned in section 2 (sewers, man-holes, cess-pools, culverts, cross-walks, crossings, curbing, grading, piling and capping excepted), is done on one side of the center line of streets, the lots fronting on that side only shall be assessed to cover the expenses of the work. It was held that, where an assessment included charges for macadamizing, as well as grading and curbing, the imposition of the whole expense of grading and curbing on a lot on one side of the street renders the whole assessment void, not only as to the grading and curbing, but also as to the macadamizing. Ryan *v.* Altschul (Supreme Court of California), 37 Pac. Rep. 339.

Effect of Advertisements for Con-

tracts.—Contracts may originate in advertisements addressed to the general public. The intent manifested by an advertisement for bids must govern in its interpretation. Where the advertisement is nothing more than a suggestion to induce offers of a contract by others, it imposes on itself no liability. An advertisement for bids, for the erection of a public school building, declared that the board reserved the right to reject any or all bids. It was a rule of the board, however, that all contracts should be let "to the lowest and best bidder." A contractor submitted a bid, which was the lowest, for the erection of the building, but the board awarded the work to another. It was held that he had no cause for action, even if the board acted "arbitrarily and capriciously and through favoritism," in awarding the contract. Anderson *v.* Board, etc., of Public Schools. (Supreme Court of Missouri, Div. No. 1), 27 S. W. Rep. 610.

Limitations of Action for Recovery of Excessive Assessments.—An ordinance of a city assessing on the property abutting on a street more than is required to pay the cost of the improvement of the street is, as to the excess of an assessment over the cost of the improvement, illegal; and, having been paid by the property owner, an action to recover back such excess, under the statute, must be commenced within one year after such payment. The fact that the passage of the ordinance was induced by a mistake in the calculation of the cost of the improvement, and that payment was made in ignorance of such mistake, will not have the effect to save the action from the limitation provided for in said statute. Groesbeck *v.* City of Cincinnati. (Supreme Court of Ohio), 37 N. E. Rep. 707.

PERSONALS.

G. H. Merridith, Sioux City, Ia., is preparing plans for a system of water-works at Moville, Ia.

Daniel W. Mead, Rockford, Ill., has been engaged to prepare plans for the water-works system at Dundee, Ill.

A board of sewer commissioners, consisting of William A. Wynn, L. T. Mulhearn, and Archibald Mutch, has been appointed at Far Rockaway, N. Y.

Prof. Edward N. Boggs, of the civil hydraulic engineering department of the University of Arizona, has been appointed territorial irrigation engineer, by Governor Hughes.

Prof. F. P. Van Denbergh, of Buffalo, N. Y., has been retained by the city of Peoria, Ill., in the asphalt controversy now pending there between the city and the Fruin-Bambrick Construction Co., of St. Louis.

Messrs. John A. Wilson, J. J. de Kinder and Alphonse Feldpauche compose the committee of engineers, appointed by Mayor Stuart, of Philadelphia, to examine the Queen Lane reservoir, which is in course of completion.

Prof. Ira O. Baker, of the University of Illinois, who is the author of some of the best of the literature on the subject of brick pavements, should have been credited with several extracts, in the article of J. A. Hall, C. E., in "Specifications for brick Pavements" which appeared in the October number of this magazine.

LETTERS FOR THE PUBLIC.

DIFFERENCE BETWEEN CAPACITY AND AREA OF SEWER PIPES.

To the Editor of Paving and Municipal Engineering:

SIR—Your correspondent, Mr. F. R. Lockling, C. E., in his letter on page 188 of your October magazine, is entirely wrong in his method of finding the diameter of a pipe equal in *capacity* to two or more pipes.

His method is right if he wishes to find the diameter of a pipe equal in *area* to the combined areas of two or more pipes, but there is a great difference between *capacity* and *area*.

The diameter of a sewer equal in capacity to two others of 8 inches and 6 inches diameter is about 9 inches, instead of 10 inches as given in his first example. In his second example the diameter of a pipe equal in capacity to that of a 16-inch and a 12-inch, is a little more than 18 inches (really 18¼ inches, for which an 18-inch pipe would answer), instead of 20-inch pipe as given by his rule.

In his last example he finds that a pipe 16.1245 inches in diameter is required to equal in capacity that of four pipes, 12 inches, 6 inches, 8 inches, and 4 inches, in diameter, respectively. In reality the diameter of a pipe of a capacity equal to the above four is a little less than 14 inches.

The discrepancy in this *rule for capacity* of pipes is due to the fact that your correspondent has confounded the terms AREA and CAPACITY. *T. J. McMinn.*

New York, October 10.

SELECTIONS FROM THE PRESS.

BRICK PAVING TO T RAIL.

A neat and competent liner of special mold is in use at Peoria, Ill., where brick paving largely obtains. This form is made in two styles, as shown in the accompanying illustrations. The small brick, Figure 1, is 8 inches long, 2½ inches wide and 4 inches deep. It is beveled at the bottom at a sufficient angle to allow for the rail foot

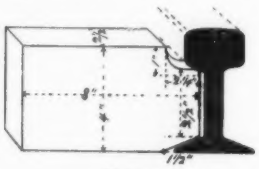


FIG. 1.

or base and curved at the head to admit the rail head. The web of rail for which this type is used is 2½ inches and the angle is 1½ inches long. The curve at the top allows for the wheel flange and drainage. The channel can be easily cleaned by ordinary methods.

Figure 2 shows the larger type, evidently for use in less frequented streets. This one is 12 inches long,

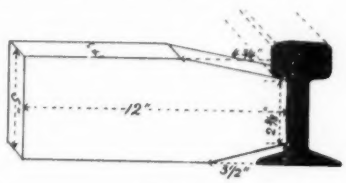


FIG. 2.

4 inches wide and 5 inches deep. It is beveled for both the head and the foot of the rail at a long, acute angle. The head bevel measures

4¾ inches and the foot bevel 3½ inches. The web of the rail to be accommodated is 2⅜ inches high.—*Brick.*

CLAYS OF WEST VIRGINIA.

In the coal measures of West Virginia valuable fire and pottery clays have been found. On the property of the Fairfax Forest M. & M. Co., Wilsonia, W. Va., a stratum of clay exists that made the finest class of paving brick. This brick was made out of the material sent west. This clay is quite high in aluminum and gives the following analysis:

Silica	45.86
Aluminum	44.23
Magnesia	0.00
Potash and soda	0.24
Moisture hygroscopic	0.70
Moisture combined, Organic matter	8.35

This clay alone makes a good fire-brick and when combined with ordinary clays produces the paving brick to which we have alluded.

On the property of the Bayard Coal and Coke Co., Bayard, W. Va., are also to be found some remarkably fine clays. These lie in three seams ranging from four to eight feet in thickness. These clays are admirable for three purposes—the manufacture of pottery, fire-brick and paving brick. This material is quite high in alumina, showing a sufficiency of that material for the manufacture of the best grade of pottery and tiling. An analysis of this material produced the following results:

Silica	54.37
Alumina	33.83
Oxide of iron	0.01
Magnesia	0.02
Potash and soda	Trace.
Moisture hys	1.00
Organic matter and moisture combined	10.86

Not only does the above test show a fine material, but the practical results from the manufacture of these clays into brick have substantiated it. Some of these clays were shipped to E. M. Freese & Co., of Galion, Ohio, and the brick made was pronounced by them as very superior. As a paving brick it is doubtful if there is a superior article made in the country. A sample of this paving brick was shown a large street-paving contractor, and he pronounced it equal, if not superior, to the kind he was using for paving purposes at present in one of the large cities of the Union. The clays should be profitably worked also into pottery ware as well as fire-brick. The material exists in very large quantities, and no place could be selected more suitable for the manufature of pottery and brick than Bayard, W. Va.—*Brickmaker.*

GALESBURG'S BRICK STREET PAVEMENTS.

The merits of the Galesburg brick as a paving material are set forth in a letter to the Chicago *Evening Post*, by F. M. Mahan, a civil engineer of that city. During a recent visit to Galesburg, Ill., Mr. Mahan made close observation of the vitrified brick pavements in that city. The favorable impression resulting from his examination is evidenced in the following: "The question of securing a desirable and practicable paving material for cities is one that has exercised and tried the patience of engineers all over the country. Any one who will take a trip through the streets of the North Side will appreciate the utter failure of cedar blocks for paving purposes. Streets that were paved with cedar blocks only three or four years ago are now in an almost impassable condition. I believe the city of Galesburg has solved the problem of street paving.

I spent two or three days in Galesburg some ten days since in connection with goods I manufacture. While there my attention was attracted to the beautiful brick-paved streets. I found that the streets of the city were paved entirely with brick. On investigation, I found that these bricks were manufactured near the city from a peculiar formation (or rather a combination of formations), a kind of shale, heavily impregnated with iron and silica. The brick manufactured from this material is different from any other I have ever seen. It is as hard as iron, does not polish from use in the streets and does not crumble or flake off, as is the case with ordinanary hard-burnt paving brick. One of these bricks subjected to a pressure of over three hundred tons broke into three pieces with a clean-cut break, but did not crumble. I saw a pavement in the street that had been down ten years, close to it another, paved with the same kind of brick, that had been down fifteen months, and I could not (from the abrasions) tell which had been longer in use."

EFFECT OF RAIN ON GRANITE BLOCKS AND BRICK.

In a recent rain we were struck by the difference in appearance between the granite blocks and brick sidewalks. The former presented a uniform glistening look, greasy, and giving insecurity to the footing of horses, a number slipping and sliding on their uneven surfaces, while we continued our observations. Most of the brick, on the contrary, had a dull look, indicating their porosity. On brick pavement there would be no polished surfaces, such as we note on the granite, which, when wet, becomes treacherous in the highest degree, and as this durable material of brick wears it maintains a roughened exterior, the good foothold continuing. Brick pavement tried elsewhere has proved to have great advantages over stone. For all these uses the handiwork of man (iron and brick for buildings, cement and crushed rock for forts, and brick for pavements), has proved immensely superior.—*Portland (Me.) Transcript.*

MACHINERY AND TRADE.

RECENT INVENTIONS.

[Reported specially for PAVING AND MUNICIPAL ENGINEERING by Chandlee & Chandlee, Washington, D. C.]

524,536. *Land-Roller.* James F. Youtz, Mountville, Pa. Filed Jan. 31, 1894. Serial No. 498,605. Claim. 1.—In a land-roller, the combination, with a hanger having an angular opening through it, of an axle-bar having a cross-section similar in shape to said opening, a roller-head, a bushing inserted in the hub of the roller-head, connections between said hub and the bushing preventing rotary and longitudinal movement of the bushing in the head, a thimble formed separately from the adjacent parts and fitting over the axle within an annular opening through the bushing, and a collar or flange formed on the outer end of the thimble and covering the joints between the parts embraced by the hub.

524,688. *Means for Treating City Refuse.* Ernest L. Ransome, Oakland, Cal. Filed Jan. 2, 1894. Serial No. 495,441. Claim.—1.

The combination of a furnace, an air-locked chamber communicating therewith, means for forcing air into said chamber, and clinker reducing devices located within the furnace and within the air-locked chamber.

526,641. *Excavator.* Terrence P. Smart, Philadelphia, Pa. Filed June 15, 1894. Serial No. 514,660. Claim.—An excavator comprising an endless chain, suitably supported and driven, having arranged thereon a series of projections or cutters yieldingly sustained on said chain by means of braces attached to said chain, and a series of carrying buckets.

524,563. *Street-Sweeper.* John H. Reynolds, Chicago, Ill. Filed May 10, 1893. Serial No. 473,700. Claim.—1. In a sweeping machine the combination of a suitable main frame, a supplemental frame pivoted therein and a brush journaled in said supplemental frame and arranged longitudinally with the direction in which the sweeper moves and means for revolving said brush. 2. In a sweeping machine the combination of a suitable main frame, a pivoted supplemental frame, a brush journaled in said supplemental frame, longitudinally with the direction of movement of sweeper, gearing for rotating said brush, a guide plate arranged in front of said brush over which the sweepings from said brush may be directed. 3. In a sweeping machine the combination of a main frame, a supplemental frame, pivoted therein, a brush journaled in said pivoted frame and arranged to rotate transversely to the direction of movement of the sweeper, an inclined guide plate pivotally supported in the main frame and arranged with its lower edge adjacent to the under side of said brush and adapted to direct the sweepings therefrom.

524,687. *Burning City Refuse.* Earnest L. Ransome, Oakland, Cal. Filed Nov. 6, 1893. Serial No. 490,183. Claim.—1. The furnace having solid walls, the upper part of the chamber of said furnace constituting a combustion chamber, and the lower part constituting a clinker cooling chamber in combination with a blast pipe communicating with the furnace, near the bottom thereof, and air exit pipes communicating therewith at or near the bottom of the combustion chamber.

524,591. *Surveying Instrument.* William Hinton, Hinton, W. Va. Filed May 25, 1893. Serial No. 475,495. Claim.—1. A surveying instrument, comprising a straight meridian scale, a distance scale, pivotally-connected with the meridian scale, both scales having graduated edges arranged to the side of their common pivot, stationary verniers on the said scales, and a protractor held adjustably in one of the verniers and adapted to be read on the said verniers. 2. A surveying instrument, comprising a pivot and arms mounted to turn thereon, a meridian scale connected with the outer end of one of the said arms, a distance scale connected with the outer end of the other arm, both scales having their graduated edges arranged to the side of the said pivot, a protractor connected with each of the scales and arranged concentrically with the said pivot, independent slides held on each of the said scales, and two scales each pivotally connected with one of the said slides.

524,628. *Steam Road-Roller.* Edward T. Wright, Springfield, Ohio, assignor to the O. S. Kelly Company, same place. Filed Feb. 2, 1894. Serial No. 498,915. Claim.—1. In a road roller, the combina-

tion with the main driving wheels, and a steering wheel or wheels, said driving wheels being provided with extended portions adapted to overlap the tread of said steering wheel or wheels, said extended portions being beveled. 2. In a road roller, front and rear wheels, as described one set of said wheels being adapted to overlap the tread of the other set, with the overlapping portions of one set beveled. 3. In a road roller, main supporting and driving wheels, and a steering wheel or wheels, the tread of which occupies a space between said main wheels, said main wheels having a substantially uniform diameter as to those portions of which project beyond the tread of the steering wheel or wheels, and a reduced and beveled portion for overlapping the tread of said steering wheel or wheels.

524,731. *Trench Machine.* Joseph L. Potter, Indianapolis, Ind. Filed April 2, 1894. Serial No. 506,368. Claim.—1. The combination with a hoisting engine, a suitable superstructure to travel on the surface, a carriage traveling longitudinally thereon, the shaft mounted on said carriage, the main drum on said shaft, the pivoted beam, the ratchet wheel, the pawl attached to said pivoted beam to lock said shaft, cables connected to the drums of a hoisting engine and passing over a series of small pulleys and connected to main drum on the shaft to move the car longitudinally in either direction.

526,675. *Earth-Scraping Machine.* Alfred F. Bernard, San Luis Obispo, Cal. Filed Oct. 11, 1893. Serial No. 487,797. Claim.—1. In a scraper, the combination with the body, the crank lever secured to the side thereof, the supporting wheels connected to and carried by the swinging levers, the forwardly extending rods secured to the forward arms or crank lever, the bail connected to the rear arms of the crank levers, and the cables for throwing the crank lever in order to raise and lower the supporting wheels with the forward and backward travel of the scraper. 2. The combination with the body, composed of side and end walls or plates, the side walls diverging, the cutting blade connected to the bottom of the rear wall, the runners secured to the bottom edge of the side walls, the cables for moving the scraper forward and backward, and the wheels secured to the body so as to have a vertical movement in order to raise or lower the body, said wheels connected to the draft cables so as to be automatically raised or lowered with the forward or backward movement of the scraper. 3. In a scraper, the combination with the body thereof, the movable cutting blade, mechanism for imparting vertical movement thereto, the yoke projecting upwardly from the cutting blade, and the rollers upon which said yokes bear as the cutting blade is raised or lowered in order to reduce the friction of its movement.

526,794. *Street-Sweeper.* Giovanni B. Siccardi, New York, N. Y. Filed May 7, 1894. Serial No. 510,338. Claim. —1. A street-sweeper consisting of a pair of side plates, fastenings for securing the same to the tail-board of a cart, a revolving brush, an endless conveyer, a pair of drums around which the conveyer travels, and buckets secured to the conveyer and adapted to close automatically upon ascending and descending, and to open automatically upon rounding the drums.

524,875. *Street-Sweeper.* William L. Tobey, Boston, Mass. Filed

November 27, 1893. Serial No. 492,188. Claim.—1. In a sweeping machine, a brush, and means to rotate it, combined with a traveling apron extended under a portion of said brush, and in contact with the surface to be swept, to receive thereon the sweepings collected by said brush. 2. In a sweeping machine, a brush, and means to rotate it, combined with a traveling apron extended under a portion of said brush, and between it and the surface to be swept to receive thereon sweepings collected by the brush, a receptacle for said material, and a conveyer, the traveling apron forming a co-operative part thereof to carry the material from the apron to the receptacle.

524,939. *Heated Paving-Roller.* Walter E. Dennison, San Francisco, Cal. Filed Dec. 16, 1893. Serial No. 493,845. Claim.—1. The herein described paving-roller comprising a metal rim inclosing a hollow space having closed heads provided with apertures for admission of air, and central hubs for an axle, a frame or carriage having a fixed tubular axle on which the roller rotates, a tank for a liquid, as gasoline, mounted on the frame outside the roller, supply-pipes connecting the tubular axle with the tank, pipes inside the roller connected to the tubular axle at points along the length thereof and extending therefrom substantially at right angle to said axle and burners fixed on said pipes in close relation to the inner periphery of the roller-rim, and regulating valves in the supply-pipes.

527,757. *Street-Sweeper.* Napoleon B. Miller, Omaha, Neb., assignor of one-half to Frederick Mohle, same place. Filed June 19, 1893. Renewed Sept. 17, 1894. Serial No. 523,235. Claim.—1. The combination with a suitable housing, mounted upon wheels and provided with projecting sills by means of which said housing can be attached to any suitable dirt wagon of two transverse broom shafts each adjustably held within said housing by means of a bifurcated bar supporting the ends of said broom shaft, said bar being pivotally secured within the broom housing and having an extended stem and an adjusting screw secured within suitable lugs of the broom housing and adapted to raise and lower said stem.

527,353. *Sprinkling Wagon.* Eugene T. Westerfield, New York, N. Y., assignor to the Westerfield Wagon and Sprinkling Truck Company, same place. Filed Oct. 20, 1893. Serial No. 488,720. Claim. —In a sprinkling wagon, the combination of a support provided with curved slots, a flanged cylinder provided with a union coupling at the bottom and rotarily adjustable in said slots, said cylinder also having the vertical slot, the cap provided with a flange having a discharge port and guided in said vertical slot, the ball and socket at the top, and connections extending to the seat of the driver, and the inlet pipe supplying the valve at the bottom.

TRADE NOTES.

W. A. Parrish, Dadenville, Ala., contemplates buying quarrying machinery.

Shale suitable for manufacturing vitrified bricks, is abundant in Shreveport, La.

A paving brick plant will be established at Poughkeepsie, N. Y., by Orr Brothers.

A fine bed of paving brick clay has been found within a short distance of Chicago.

The Vincennes Sewer Pipe Co., Vincennes, Ind., burned September 29. Loss, $40,000.

An addition is contemplated to the plant of the Williamsport Brick Works, Williamsport, Pa.

The Hoosier Vitrified and Ornamental Brick Co., New Albany, Ind., has resumed operations.

The rebuilding of the works of the Chambers Brothers Company, Philadelphia, Pa., is about completed.

The large asphalt works of Geo. A. Peabody, Pittsburg, Pa., which were recently destroyed by fire, are being rebuilt.

Mr. D. V. Purington is credited with the suggestion which led to the invention of a new clay crusher, by D. Kennedy, of Erie, Pa.

A number of Memphis parties are interested in a mine of asphalt, situated not many miles from Memphis, and near Leighton, Ala.

The Frey-Scheckler Company, Bucyrus, O., recently made a sale of a large crusher to Gustav J. Hieneann Sons, Chicago, Ill.

The Peoria Brick Company has been incorporated at Peoria, Ill., by Wm. Jack, C. T. Heald, W. W. Hammond, and L. F. Haughton.

The new asphalt plant of Hennessey Bros. & Cox, St. Paul, Minn., is about completed. The building is 100 feet long by 52 feet wide.

The establishment of a vitrified paving brick plant at Toronto, Canada, is reported. Messrs. Peter Lyall and James W. Tester, of Montreal, are interested.

A company is being organized at Jamestown, N. Y., by Charles Hunter and John Charleston, of Tionesta, Pa., for the purpose of manufacturing paving brick.

Rubble blocks, for paving purposes, are being gotten from the quarry just opened by Patrick Fahey, at the corner of Third and Cornell streets, Wilmington, Del.

Articles of incorporation have been filed by the Washington Terra Cotta Company, for the purpose of manufacturing terra cotta bricks, pipe, tiles and other articles in the District of Columbia.

The Braintree Red Granite Company has been organized at Portland, Me., for the purpose of quarrying granite. President, B. Marvin Fernald, Melrose, Mass.; treasurer, Charles B. Perkins, Salem, Mass.

The Mack Manufacturing Co., Pittsburg, Pa., secured the contract for supplying Johnstown, Pa., with 1,000,000 brick. The brick manufactured by this company will also be used to pave four streets at Washington, D. C.

The Natural Rock Asphalt Co. and the Sand Asphalt Co. have been incorporated at Denver, Colo., by J. S. Drake, H. J. Brennan, Charles A. Wilbur, J. Bradley, and S. Zucherman. The capital stock of each is $200,000.

A discovery has been made at Catskill, N. Y., of a large quantity of clay suitable for the manufacture of vitrified brick. A company is being organized by New England and Western capitalists, with a capital stock of $150,000.

The largest brick and tile works in the United States will be built at Ellwood, Pa., at once, by H. H. Shields, of Girard, and others. The building of this plant will consolidate all of the brick and tile plants in that part of the state that are owned by capitalists interested in this enterprise.

Extensive fields of asphaltum have been discovered at Redfield, Ia., in which Eastern capitalists have made heavy investments and will expend a large sum of money in getting it upon the market.

The Decatur Leader Manufacturing Company, Decatur, Ill., has made recent sales of brick-making outfits, as follows: Oelwein Brick Company, Oelwein, Iowa; Decatur Brick and Tile Company, Decatur, Ill., and an oufit for blocks, at Bedford, Iowa.

Advices have been received at the American office of the Compagnie Générale des Asphaltes de France (35 Broadway, New York) that the company has received the highest gold medal prize at the International Exhibitions at both Lyons and Antwerp, for superiority in quality of their Seyssel and Mons Asphaltes and excellence of work.

The Syracuse Portland Cement Company will, within a short time, begin the erection of a large plant for the manufacture of cement, on a site containing 100 acres of land. The company is composed of J. M. Toucey, J. B. Dutcher, D. H. Burrill, Little Falls; L. D. Crocker, Buffalo, and H. S. Holden, Jacob Crouse, Horace White, Wing R. Smith and Edward A. Powell, of Syracuse.

A tract of five or six acres of land has been leased by the council of Columbus, Ga., for the purpose of obtaining rock with which to macadamize Broad street. The quality of stone is said to equal Lithania granite. A rock crusher will be purchased.

The manufacturers along the Piscataqua river, in New Hampshire and Maine, have organized as the Piscataqua Brick Manufacturers' Association, the object of which is to protect and increase the business. The officers of the company are: President, E. Oscar Pinkham; vice-president, John Raitt; treasurer, J. W. Clements; secretary, D. L. Pinkham, Dover Point. Capital invested, $150,000.

The Carson Trench Machine Company of Charlestown, Boston, have issued a new illustrated catalogue bearing upon a recent acquisition to their line of trench excavating machinery. The subject of it is "The Carson-Lidgerwood Sewer Cableway," which is the only cable sewer machine on the market, and the photographs of this machine show it to be extremely simple in construction while the testimonials vouch for its effectiveness. A dozen contractors and the cities of Baltimore, Md., Lowell, Mass., and Manchester, N. H., have already purchased them. This catalogue is sent free to those interested.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

The West Main street paving, at Urbana, Ill., is about completed.

Bids are invited until November 9, St. Louis, Mo., for reconstructing sundry alleys.

The proposed paving of West Eleventh street, Erie, Pa., has been indefinitely postponed.

The paving of Nicollet avenue, Minneapolis, Minn., has been deferred until next spring.

The paving of College avenue, Trenton, Mo., has been completed and gives good satisfaction.

Bids will be received until November 17, for macadamizing Sherman avenue, in Norwood, O.

Bids are invited, at Muncie, Ind., until November 5 and 12, for paving sundry sidewalks with paving brick.

The estimated cost of the proposed macadamized road from Buffalo, N. Y., to Niagara Falls, is $500,000.

The paving of parts of Stephenson, Walnut, Cherry and West streets, Freeport, Ill., has been completed.

Vanderbilt avenue, Brooklyn, N. Y., which is being repaved its entire length with granite blocks, will be completed this year.

Sealed proposals will be received, at Houston, Texas, until November 5 and 12, for the construction of sidewalks in sundry streets.

The new brick pavement on Main street, at Laporte, Ind., has been accepted by the council. The cost of the pavement was $23,702.94.

Main street, Salamanca, N. Y., has been completed at a cost to the property-owners of $7,500. Other streets will be paved next spring.

A party of city officials from Camden, N. J., visited Wheeling, W. Va., recently, to inspect the extensive brick street paving in that city.

It is probable that during the meeting of the next legislature, a repeal will be asked of the boulevard act, by which portions of Grand avenue, and Prospect avenue, Milwaukee, are closed to heavy teaming.

Sealed proposals are invited, at Hamilton, O., until November 6, for paving, with cement and bricks, sidewalks in Third and Franklin streets.

Crook's street, Green Bay, Wis., recently paved with cedar blocks, is said to be a beautiful street. Walnut street is now in course of construction.

The system of cleaning the asphaltic streets in Milwaukee with hand scrapers and brooms is similar to the system in vogue in Berlin, Germany.

A citizens' committee has been organized at Chestnut Hill and Highland Park, Richmond, Va., to improve the streets and make other needed improvements.

Detroit, Mich., is experimenting with the Hayden block brick for street pavements. Although one of the oldest blocks made, it has never been given a trial in Detroit.

Costello & Neagle, contractors for paving Lake street with vitrified brick, at Elmira, N. Y., have finished the contract. The improvement is the best made in the city for years.

The property-owners on Union street, between Front and Second, Seattle, Wash., will pave at their own expense. The city will furnish a suitable steam roller for compacting the foundation.

The vitrified brick pavement on Chestnut avenue, Trenton, N. J., has been accepted. The cost was about $2.07 per square yard. It is considered one of the best and cheapest pavements ever laid in the city.

Delaware street, which unites Buffalo and North Tonawanda, N. Y., is now paved its entire length, which is more than 10 miles. One-half is paved with brick, and the other half with asphalt. Cost was $312,000.

Since the completion of the pavement on Louisiana avenue, at New Orleans, La., it is pronounced complete and satisfactory. Some discussion has been aroused regarding the crossings, whether they should be of block, vitrified brick, cypress or flagstone.

A piece of bitumen pavement, which has been laid for ten years, on Broadway, Oakland, Cal., is just beginning to show signs of disintegration. It was laid on top of the old macadamized roadbed, and while subjected to the heaviest traffic in the city, has never been repaired in any way.

When completed, Prior street, Atlanta, Ga., will give that city one of the longest and finest drives in the South. It will begin at Georgia avenue and for three-quarters of a mile it will consist of a brick pavement; to the corner of Peachtree and Ellis it will be of Belgian block; to the city limits it will be of asphalt; for a quarter of a mile beyond the city limits chert has been laid, with the probability of extending it in the future. The length of the drive is now a little less than three miles.

CONTEMPLATED WORK.

Main street, Colfax, Ill., will be graveled.

Tremont, Ill., contemplates doing some street paving.

The paving on N. Market street, Canton, O., will be extended.

Michigan avenue, at Lansing, Mich., will be paved with brick.

Commercial avenue, Binghamton, N. Y., will be paved with asphalt.

Market street will probably be paved with asphaltum, at Chester, Pa.

West State street will be paved with vitrified brick, at Trenton, N. J.

The question of paving Vine street with brick is being considered at Lexington, Ky.

Fourth street, from Main to Pearl, will be paved with vitrified brick, at Camden, N. J.

A great deal of paving and repairing is contemplated for next year, at Omaha, Neb.

The city council, at Litchfield, Ill., has decided to experiment with brick crossings.

Plans are being prepared at Chattanooga, Tenn., for repaving Vine street with brick.

An appropriation of $5,000 has been made at Mamaroneck, N. Y., for improving Weaver street.

An asphaltic pavement is proposed for the entire length of Burnside street, Portland, Oregon.

N street, from Twenty-fourth to Twenty-seventh, Omaha, Neb., will be paved with vitrified brick.

A vitrified brick pavement has been proposed at London, Ont., for two blocks of Dundas street.

Eighth street, East St. Louis, Ill., will be paved with vitrified brick, for the distance of more than a mile.

Rotterdam street, from the boundary line between the city of Schenectady, N. Y., and the town of Rotterdam, has been ordered paved.

Munroe street, Memphis, Tenn., will be paved with brick, on a 7-inch concrete foundation, for $4,532.

Tyler avenue, from Main to Second street, Elkhart, Ind., will be paved under the direction of the city.

Main street, at its intersection with Second street, at Jamestown, Pa., will be paved with Medina stone.

The list of streets scheduled for improvement during the next fiscal year, at Washington, D. C., is completed.

An appropriation of $400 has been made at Reading, Pa., for paving Walnut street between Fourteenth and Birch.

An asphalt pavement will be constructed on Delaware street, from Tenth to Fourteenth streets, Indianapolis, Ind.

The property owners on Oneida street, Appleton, Wis., have petitioned for an extension of the paving on that street.

The city of Peoria, Ill., has under consideration for next year eight miles of brick paving and seven miles of asphalt.

Attention has been called to the brick pavements in the business portion of Americus, Ga., which are in need of repair.

The members of the B. of A., at Cincinnati, O., are contemplating a scheme which embraces the paving of every alley in the city with granite or brick.

The estimated cost of the proposed paving of Talbot street, from the east line of Shelby street to the west line of Main, at Memphis, Tenn., is $1,384.70.

An ordinance has been drafted at Quincy, Ill., providing for twenty-five blocks of street paving next year, and provision will be made, a little later, for more.

The council at New Haven, Conn., has recommended that a sheet asphalt pavement be laid on George street, between Orchard street and Sherman avenue.

The property-owners on Troost avenue, at Kansas City, Mo., are anxious to pave. If the plans contemplated are carried out six blocks will be paved with asphalt.

It has been recommended to the Lincoln Park board, Chicago, Ill., that Diversey street be made a boulevard, as a connection between the North-side and West-side park systems.

Ordinances have been passed at Columbus, O., for paving Hawkes and Rogers avenues, and part of High street, with asphalt, stone block, or brick, and setting a five-inch curb.

Some of the citizens at Salt Lake City, Utah, are agitating the extension of the newly macadamized State road to connect with the asphalt pavement at the intersection of Fourth South street.

Wyandotte street, between Ninth and Twelfth, Kansas City, Mo., will be paved with asphalt on concrete. Thirteenth street property owners have petitioned that asphalt be laid on that street.

The committee on public works, of Pittsburg, Pa., recently recommended for passage, ordinances for paving the following: Friendship and Collins avenues; Boquet Bellefonte and Noble streets, and sundry alleys.

The board of public works, at St. Paul, Minn., recently voted to pave with asphalt, the following streets: Fifth, from Wabasha to Third street; St. Peter, from Third to Martin, and Sixth from Rosabel to Smith avenue.

The board of public works at Milwaukee, contemplates paving Grand avenue, from Thirteenth street to Western avenue, with asphalt, next summer. If done, it will give the city a continuous asphaltic drive from one side of the city to the other.

An ordinance, providing for the paving of several streets at Jacksonville, Fla., places the estimated cost of each street as follows: Forsythe street, vitrified brick, $26,821; Adams street, Alachua rock, $6,019; Ocean street, Alachua rock, $4,643; Clay street, Alachua rock, $3,966; Cedar street, Alachua rock, $5,653; Adams street, Black creek marl, $4,132.

CONTRACTS TO BE LET.

Bids are invited, until November 9, Avondale, O., for improving Greenwood avenue.

Bids are invited, at Fostoria, O., until November 14, for paving Tiffin street with paving brick or blocks.

Sealed proposals will be received until November 9, Hamilton, O., for paving Millville pike with cement.

Sealed proposals will be received, at Cincinnati, O., until November 8, for paving Albion Place with brick.

Bids will be received until November 3, at Council Bluffs, Ia., for paving with vitrified brick, Oakland avenue.

Bids will be received until November 10, at Missoula, Mont., for building a wagon road around the point of rocks known as Bad Rock.

Bids are invited until November 5, Cincinnati, O., for paving, with asphalt, Seventh street, from Vine to Main, and with brick, Clifton alley.

Sealed proposals will be received, until November 9, at Bangor, Me., for furnishing the city with 100,000, more or less, granite paving blocks.

Bids are invited, at Louisville, Ky., until November 9, for improving Grayson and Twentieth streets. The contract will also be let for several sidewalks.

Sealed proposals will be received, until November 10, Tiffin, O, for improving Clinton avenue and making the roadway of broken stone to a depth of ten inches, and covering the same with crushed stone or gravel, to a depth of four inches.

Bids will be received, at Terre Haute, Ind., as follows: Until November 26, for paving Ohio street, with asphalt on a concrete foundation; Eleventh and Fifteenth streets, with screened gravel. Until November 6, Liberty avenue, alley from Park to Crawford street, and Thirteen and a half street, screened gravel.

CONTRACTS AWARDED.

Main street, at Niagara Falls, N. Y., will be paved with Park brick, by Noblett & Co., at $2.18 per yard.

The Indiana Clay Co., of Veedersburg, Ind., will furnish the brick for paving the streets at Logansport, Ind.

The contract for paving East Milwaukee street, Janesville, Wis., with Cedar blocks, was awarded to Ryan & Brown.

The contract for an asphaltic pavement on Main street, at Poughkeepsie, N. Y., was awarded to the Hastings Paving Company.

Woodcock & Kneal secured the contract for paving Washington avenue, at Lansing, Mich., for $16,592.65. Brick will be used.

Bisbee & Foster were awarded the contract for street paving in Jacksonville, Fla., on Laura, Julia, Duval, Ashley and Market streets.

The contract for paving Montgomery street with vitrified brick, at Trenton, N. J., was awarded to Michael Hurley, for $1.85 per square yard.

John F. Bretz & Son, of Springfield, Ill., have been awarded the contract for laying 12,000 yards of brick pavement at Sullivan, Ill., at a cost of $30,000.

The contract for paving Monroe street, between Main and Second, at Memphis, Tenn., with vitrified brick, has been awarded to Ed. Holly, for $4,614.55.

Wm. McMahan was the lowest bidder at Toledo, Ohio, for paving Fourteenth and Tecumseh streets with vitrified brick, Hallwood block, and Medina stone.

Nicholas & Fahey secured the contract for paving West Lackawanna street, Scranton, Pa., with Belgian blocks, at $1.99 per square foot, and curbing at 49 cents a foot.

The macadam road board of Hempstead, N. Y., awarded to DeWitt C. Banker, Jr., of Brooklyn, the contract for macadamizing Village avenue, Rockville Center, at $2.33 per running foot for 18 feet in width and 32 feet wide pro rata.

The contract for paving Delaware street, Leavenworth, Kan., with vitrified brick, was awarded to T. K. Smith. The bricks are manufactured by John Gaffney, Atchison, Kan.

Thomas Lally was the lowest bidder at St. Paul, Minn., October 16th, for brick and granite paving on Summit avenue. His bid was $2,530 for brick paving, and $2,995 for granite.

A. P. Stultz, Zanesville, Ohio, made a recent visit to the city of Mexico, to close a contract with the government for paving one of the principal drives of the city with Zanesville brick.

The contract for paving Harrison street, from Main to Superior, at Ft. Wayne, Ind., was awarded to Herman Tapp. Mack fireclay brick will be used on a six-inch concrete foundation, with two inches of sand. The contract price is $9.02 per lineal foot.

The largest single contract ever awarded in Kansas City, Mo., for asphalt paving, was recently awarded the Barber Asphalt Paving Co., when it was given the contract for Fourteenth street, for $51,531.07. Other contracts awarded are as follows: Garfield avenue, Barber Co., $6,480; Penn street, with brick, William Williams, $1,347.50.

SEWERS.

A $25,000 system of sewerage is being put in at Bridgeport, O.

The sewerage system of district No. 2, at Findlay, O., will be changed.

A local sewer will be constructed in Division Street, at Evansville, Ind.

Sewers will be constructed in Sanford Place and Zabriskie street, at Jersey City, N. J.

Waterloo, Ia., expended $9,000 during the present season, for 14,000 feet of additional sewerage.

Applications have been made at White Plains, N. Y., for a sewer extension through Cromwell Place.

During 1894 eleven miles of sewers have been constructed at Des Moines, Ia., at a cost of $125,156.47.

An expenditure of $16,000 has been authorized at Norfolk, Va., for additional facilities to sewerage pumping station.

The large Hotel street sewer, which was begun last December, at Utica, N. Y., has been completed at a cost of about $50,000.

The new system of sewerage which has been adopted at the Maryland Hospital for the Insane, near Catonsville, Md., has proven very successful and satisfactory. The principal feature of the system is the purification of sewage by the application of land.

The sewer commissioners at Woburn, Mass., have concluded that it will be inexpedient to commence sewer construction this year.

The East side intercepting sewer is in course of construction, at Des Moines, Ia. It will take two years to complete it and it will cost $50,000.

Bids were received, at Ripon, Wis., October 26, for the construction of about 20,000 lineal feet of vitrified pipe sewer and 1,100 feet of 30-inch brick sewer.

The construction of sewers which has been in operation at Marinette, Wis., for seven months, is completed. About five miles of sewers have been built.

The city council at Salt Lake City, Utah, has set aside $170,000 more as a sewer fund with which to complete the gravity sewer, which will increase the total cost to $373,841.

The final estimate of Spinks & Son, Lexington, Ky., for building sewers on West Main, High and Walnut streets, was accepted and payment recommended, recently. The cost was $7,865.70.

A sewer is being constructed at Nicetown, Pa., by Wm. H. H. Achuff, of West Philadelphia, in which unusual difficulties are encountered. The sewer and storm-water conduit are being built in one trench, the depth of which averages 28 feet. The sewer is 3 feet 6 inches, drains eastwardly and will connect with others leading to the Delaware, while the conduit, which is 6 feet 3 inches in diameter, is intended to carry storm-water to the Schuylkill river. It will pass under a railroad and oilcloth factory, the tunneling under which is of a dangerous character and necessarily slow. The storm-water conduit will ultimately connect with a section built several years ago.

CONTEMPLATED WORK.

Sewers are proposed for Conshohocken, Pa.

A sewer system is contemplated at Manchester, Ia.

A sewer will be constructed in State street, Erie, Pa.

A system of sewers is still contemplated at Waynesburg, Pa.

The council at Astoria, Ore., voted for a sewer on Fifth street.

The proposed new sewer at Kalamazoo, Mich., will cost $4,500.

The business men at Wahpeton, N. D., are in favor of a sewerage system.

A system of pipe-sewers, with a brick outlet, will be built at Sterling, Ill.

The extension of the city's sewerage system is again being agitated at Red Wing, Minn.

The city of Hillsboro, Texas, contemplates constructing a sewer system.

An improvement in the drainage system at Savanna, Ill., has been proposed.

The sewer in the vicinity of Cheever street, Ansonia, Conn., will be relaid.

A twelve-inch local sewer will be constructed in Limestone street, at Springfield, O.

The city council at Fort Dodge, Iowa, has ordered five new sewers to be constructed.

The proposed brick sewer through Ferry street, at Hoboken, N. J., will be constructed.

An ordinance has been passed at Du Bois, Pa., relating to the construction of a system of sewers.

The plans and specifications for the proposed system of sewerage, at Woodbury, N. J., are completed.

Plans for the sewerage system at Fulton, N. Y., have been prepared by Civil Engineer Smith, of Troy.

A sewer district will be formed at Oakland, Cal., for the construction of a main sewer for Cemetery creek.

The city council at Columbus, O., declares necessary the construction of a 12-inch pipe sewer in McCoy street.

The proposed sewerage system of Ithaca, N. Y., has again been taken up, for the purpose of taking action on it.

The aldermanic action ordering the construction of the Dinges street sewer, at Buffalo, N. Y., has been approved.

Ordinances are pending at Chester, Pa., for the construction of sewers in Edgmont avenue and Fulton and Third streets.

Sewers were recently ordered constructed at Washington, D. C., in Seventh and Prospect streets, and in alley square 912.

The board of trustees at White Plains, N. Y., has been petitioned for an extension of lateral sewer mains in Mamaroneck avenue.

A cylindrical brick sewer in the alley, between John and Smith streets, Toledo, O., was recently provided for by the common council.

Petitions have been made at Patterson, N. J., for sewers in North Fourth, East Twenty-third, Perry, and along Grand to Morris streets.

Sewers and drains will be constructed in that part of District 2, Division 2, including Vanhorne alley, Seventh street, Barr street and Kenyon avenue, between Baymiller street and Freeman avenue, and Laurel alley, between Vanhorne alley and Seventh street, at Cincinnati, O.

Sewers were recently ordered constructed in E. Eleventh and E. Twelfth streets, at Tyrone, Pa. A system of sewerage is very much needed in that borough.

Plans are being prepared for a large sewer at East St. Louis, Ill. Mayor Stephens' idea is to have one large main in the southern part of the city, into which all the smaller sewers may empty.

A movement that is unanimously favored is contemplated in several towns in Pennsylvania. The plan provides for sewering Chartiers, Crafton, Carnegie, Glendale, Heidelberg and other towns. The sewer will begin at a point above Carnegie and will be at least six feet in diameter and more than seven miles long. Its estimated cost is $160,000.

CONTRACTS TO BE LET.

Bids will soon be asked for sewer construction at San Antonio, Tex.

Bids are invited, at Cranford, N. J., until November 8, for the construction of sewers.

Proposals will be received until November 8, at Halifax, N. S., for a loan of $20,000 for sewerage purposes.

Bids will be received until November 10 for furnishing city sewer pipe for two years to the city of Akron, O.

Sealed proposals will be received until November 3, at Dubuque, Ia., for building a pipe sewer in West Fourth street.

Sealed proposals for constructing a semicircular arch culvert in the Banklick road will be received at Cincinnati, O., until November 10.

Sealed proposals will be received, at South Bend, Ind., until November 12, for the construction of a pipe sewer as follows: About 440 feet 18-inch, 460 feet 15-inch and 265 feet 12-inch.

CONTRACTS AWARDED.

Thomas R. Sullivan was awarded the contract for laying a sewer in Thirteenth street, at College Point, N. Y.

Wilding, Derheimer & Co. have the contract for constructing a local sewer in Mississippi street, at Indianapolis, Ind.

The contract for constructing the sewer system at Cazenovia, N. Y., was awarded to Nicholas Beckrich, of Tonawanda, for $25,000.

Contracts for sewer construction have been awarded at Newark, N. J., as follows: Lillie street, 15-inch pipe sewer, Michael Condon, 50 cents per lineal foot, and $27 for each man-hole; Third street and Fairmount avenue, pipe sewer, James McGuire, 55 cents per lineal foot, $90 for catch-basins and $22 for man-holes.

WATER-WORKS.

The water mains for the water-works system at Penn Yan, N. Y., are all laid.

The pumping station of the water-works at Ellicottsville, N. Y., is completed and in operation.

A serious break occurred in the new reservoir at Lancaster, Pa., October 13th, causing much damage.

CONTRACTS TO BE LET.

Sealed proposals are invited, at Oswego, Ill., until November 5, for additional water mains.

Bids are invited until November 8th, for the construction of a water-works system at Talmage, Neb.

Sealed proposals will be received at Beaver Falls, Pa., until November 6th, for a complete filtering plant.

Sealed proposals will be received at Sioux City, Iowa, until November 6th, for the Morning Side water-works system.

Bids will be received until November 7, for the construction of a pump and boiler-house, and a new water supply for Fort Reno, O. T.

Bids will be received at Union City, Ind., until November 15th, for furnishing and laying water mains, and furnishing iron water pipes, gates, valves, etc.

Sealed bids will be received at Stamford, N. Y., until January 1, 1895, for the construction of reservoir and pipe line for addition to the Stamford Water Company's plant.

All bids were rejected, at Rossville, Ill., recently, for the construction of water-works, and new bids will be received until November 10, on the same plans and specifications.

CONTRACTS AWARDED.

The water-works company at Carthage, Mo., has contracted for a filter.

Fairbanks, Morse & Co., of Chicago, were awarded the contract for a water-works system at Frankfort, Ill., for $4,150.

The contract for constructing water-works at Guttenberg, Ia., was awarded to Burke Bros., of West Superior, Wis.

Whitney & Son, of Quincy, Mich., secured the contract for constructing the water-works system at Union City, Mich.

The Challenge Windmill Co., of Batavia, Ill., was awarded the contract for the water-works plant at Clarksville, Ia., for $7,180.

The contract for erecting a water-works plant at Grenada, Miss., was awarded to De Long, Howard & Co., of Lexington, Ky., for $25,000.

The contract for the extension of the water-works system at Zumbrota, Minn., was awarded to H. A. Olsen & Co., of Stillwater, for $4,456.

The contract for the new water-works system at Niles, Mich., has been awarded to John H. Symons & Co., of Chicago. The system will cost $75,000.

The system of water-works at Springville, Ia., will be constructed by Fred Knowlton, of Marion, and R. C. De La Hunt, of Cedar Rapids, for $3,212.

The U. S. Engine and Pump Co., of Batavia, Ill., has secured contracts for the construction of water-works as follows: Forreston, Ill., $6,354.35; Marengo, Ia., $10,000; Elysian, Minn., $4,130.

CONTEMPLATED WORK.

Akron, Ia., has voted in favor of water-works.

An extension of water mains is urged at Quincy, Ill.

Apalachicola, Fla., contemplates the construction of water-works.

A better system of water-works is proposed for Bay St. Louis, Miss.

Warsaw, N. Y., will be bonded for $50,000 for the construction of water-works.

An ordinance has been passed at Lebanon, Pa., providing for an additional water supply.

A water-works plant will be constructed at Lakewood, N. Y., next season, at a cost of $15,000.

The water supply at St. Paul, Minn., is very poor, and steps are being taken to improve it.

A system of water-works will be constructed at Oakesdale, Wash. A bid of $24,000 has been offered.

A company has been organized at O'Fallon, Mo., to construct and operate a water-works system, at its own expense.

A new condensing pump of 5,000,000 gallons capacity is said to be an imperative necessity for the water-works station at Aurora, Ill.

Water-works are being agitated at the following places: Russellville, Ala.; Decatur, O.; Ligonier, Pa.; Carrollton, O.; Irvington, Ind.

The construction of water-works is contemplated at the following places: Greenwood, Ind.; Moville, Ia.; Eureka, Cal.; Allerton, Ia.; Elmwood Place, O.; Lorain, O.; Terrell, Tex.; Flushing, Mich.; Dunlap, Ia.; Oxford, Mich.; West Bend, Ia.; Elberton, Ga.; Glassboro, Pa.; Sumner, Ia.; Mt. Pulaski, Ill.; Port Clinton, O.; Florence, Colo.; Cuthbert, Ga.; Vevay, Ind.; Leavenworth, Ind.; Charlestown, Ind.; Knoxville, Ill.; Cascade, Ia.

BRIDGES.

Several iron bridges will be built in Grayson county, Texas, soon.

A new bridge is being urged for South Portland, at Portland, Ore.

The proposed North Ninth street viaduct, at Lincoln, Neb., will cost $150,000.

The question of a bridge is being agitated, to cross the Illinois river, at Hennepin, Ill.

Bids are invited, at Meridian, Miss., until November 5, for erecting three county bridges.

The Indiana Bridge Co., Muncie, Ind., secured the contract for a bridge at Plainfield, Ind.

The Pleasant run bridge, at Indianapolis, will be built by the Toledo Bridge Co., for $7,425.

A bridge is being erected across the Susquehanna river, at Plymouth, Pa., by the Penn Bridge Company.

A new steel bridge has been ordered built by the council at Chippewa Falls, Wis., across Duncan creek.

The contract for a new bridge across the main street of Clayton, Ia., has been awarded to Kuempel Bros.

The construction of the new bridge across the creek in Jefferson street, Lockport, Ill., has been postponed.

The Pueblo Bridge Co. secured the contract for reconstructing the Washington avenue bridge, at Golden, Colo.

A vote will be taken at Toledo, O., November 6th, regarding the construction of a bridge across the Maumee river.

The Mt. Vernon Bridge Co. secured the contract for the superstructure of the Columbus street bridge, at Cleveland, O.

The Wrought-Iron Bridge Co., Canton, O., was awarded the contract for the First street bridge, at Indianapolis, for $32,000.

A new iron bridge will probably be built across the river at Menominee, Mich., this winter. The city has bonded itself for $8,000.

The residents of Riverside and Sedamsville, Ohio, have petitioned for a new bridge over Boldface creek, at West Sixth street.

A new bridge will be built on the Lexington road, over the creek at the line of Richland and Knox counties, near Palmyra, O.

The Milford bridge has been accepted by the commissioners of Hamilton and Clermont counties, O. The bridge is pronounced the handsomest structure in southern Ohio. Cost, $40,000.

Sealed proposals are invited, at Houston, Tex., until November 26, for a bridge across Buffalo bayou, at the foot of Factory street.

The contract for the bridge across the St. Joseph river, at Buchanan, Mich., was awarded to the Detroit Bridge Company for about $14,000.

The new bridge across Eel river at Mexico, Ind , has been completed at a cost of $8,995. The La Fayette Bridge Company had the contract.

A double-deck steel bridge will probably be built across the Schuylkill, at Gray's Ferry road, Philadelphia, Pa. Estimated cost, about $800,000.

The Indiana Bridge Co., Muncie, Ind., secured contracts for three hydraulic bridges at Connersville, Ind., at Seventh, Eighth and Eleventh streets.

The bridge at Perry street, Toledo, O., will be built by the Toledo Bridge Company. This company also secured the contract for the Swan creek bridge.

The contract for a new bridge across the canal, on Main street, at Circleville, Ohio, was awarded to the Iron Substructure Company of Columbus, for $1,950.

The contract for the superstructure of the South Rocky river bridge, which was awarded to McAllister & Dall, has been bought by the King Bridge Co., for $94,100.

The plans and specifications for the new lift bridge across the canal at North Adams street, Lockport, N. Y., have been made. It will be operated by a turbine wheel and will cost from $15,000 to $16,000.

The Bridge Commission of Hamilton, O., has engaged the Osborne Engineering Co., of Cleveland, O., to take charge of the construction of the new High and Main street bridge. Work will begin November 1st.

Sealed proposals will be received until November 9, at New Orleans, La., for constructing an iron bridge across the Carondelet Navigation canal at the intersection of Hagan avenue. Also, at its intersection of Roman street.

The Wrought Iron Bridge Co., of Canton, O., has the contract for completing the Twelfth street bridge at Boulder, Colo., furnishing all iron to repair the Seventeenth street bridge and building a new bridge on Twelfth street.

The plans and specifications for the contemplated completion of the Fourth street viaduct between Denver, Colo., and Highlands, includes putting in two new bridges, new planking, vitrified brick paving, and an approach on Water street. The estimated cost for completing it is $110,373.36.

A new steel bridge will be built at Globeville, Colo., across the South Platte river at Thirty-eighth street. The plans provide for a two-span bridge of three Pratt trusses, with two sixteen-foot roadways and two eight-foot walks, the whole to be based on tubular foundations.

The new bridge over the Cuyahoga river, Akron, Ohio, is completed. It is 516 feet long, including a span of 120 feet, over the Cuyahoga river, and has 396 feet of viaduct approach, roadway 24 feet wide between railings, and a street car track occupying space at one side. The Wrought Iron Bridge Company, of Canton, Ohio, designed and built the bridge.

PARKS.

A public park is being agitated at Redlands, Cal.

Fort Dodge, Ia., contemplates having another park.

The park question is being agitated at Pasadena, Cal.

The barracks at Newport, Ky., will soon be converted into a public park.

St. Louis, Mo., is said to have the finest public park system in the United States.

Portland square, Duluth, Minn., is being planted with trees and flower bulbs this fall.

An ordinance has been passed at Eureka, Cal., respecting the acquiring of lands for a public park.

Louisville, Ky., will vote on the issue of bonds for $1,000,000, for the improvement of public parks.

The citizens of East Toledo, O., have asked the park commissioner for property for park purposes.

Small parks will be established at Pittsburg, Pa., by Mayor Kennedy, in the hill districts, for the benefit of the residents.

A resolution was passed at St. Paul, Minn., recently, preliminary to the condemnation of land to be used for park purposes.

A public park is needed at Memphis, Tenn. The purchase of Jackson Mound Park, and the ground east of it, has been suggested.

Minnehaha Park, at Minneapolis, Minn., has undergone a number of improvements during the year. The work will be continued next year.

A new public park is proposed at Troy, N. Y. The lands situated about the reservoirs can be easily transformed into a park, and it is probable that action will be taken at once.

The board of park commissioners, at Peoria, Ill., have purchased another ten acres of ground, which will be added to their park system.

The city of Grand Rapids, Mich., is discussing the feasibility of selling Lincoln park and purchasing additional ground for John Ball park.

Edgewood avenue, New Haven, Conn., will probably be laid out in accordance with the park system which is established within the city line.

Surveys have been made, partly in Milford, Amherst, and other places in New Hampshire, preparatory to the purchase of land for a game park. If purchased, it will include hundreds of acres.

A splendid system of parks is being mapped out for Rochester, N. Y. As planned now, the board of park commissioners will begin at the Genesee Valley park and build a parkway on the east side of the river around the city, to a point below the lower falls, which will connect with Highland park.

A park system is being considered at Indianapolis, Ind. As a preliminary move, Mr. Joseph Earnshaw, of the firm of Earnshaw & Punshon, Cincinnati, in company with the Commercial Club Committee on Parks, looked over the city on October 30, with a view to recommending the selections of land suitable for park purposes.

A system of river parks is under contemplation at Boston, Mass., to extend from Boston to Newton. The last legislature voted to the park commissioners $300,000 with which to buy the salt marshes lying between Newton and the Cottage Farms, which will be cultivated, and a series of beautiful parks along the banks of the Charles river will be established.

STREET RAILWAYS.

Grass Valley, Cal., and Nevada City will be connected by an electric railway.

A gravity road has been proposed at Philadelphia through the West Park.

A double-track railway extension has been recommended on Avenue road, Toronto, Canada.

The Saginaw Electrical Street Railway Co. will unite the Saginaw Valley cities by an electric road.

An electric line is contemplated between the Madison and Denverside tracks at East St. Louis, Ill.

The city council at Norfolk, Va., has been asked for a franchise to build an electric railway from Sewell's point to Ven de l'Eau.

The electric system is to be introduced on the roads of the Victoria Phosphate Co., at Newberry, Fla.

An electric railway line will be established from Perrysburg, O., to Bowling Green, thence to Portage.

The contract has been awarded for the new trolly line which will connect Frankford, Pa., and Germantown.

The branch line of the Cumberland Valley Traction Co., Harrisburg, Pa., will be completed to Carlisle and Boiling Springs.

A contract has been closed for building an intramural electric railway on the Cotton States and International Exposition Grounds, at Atlanta, Ga.

Julian Fishburne and others have petitioned the city council of Charleston, S. C., for the right to construct and operate street car lines in certain streets.

Action for the franchise for the interurban railroad has been deferred by the city council at Kaukanna, Wis., in order that a proper route through the city might be agreed upon.

The Peekskill, State Camp and Mohegan Railroad Co. has been incorporated at Peekskill, N. Y., to operate a street railway from Peekskill to Lake Mohegan, a distance of four miles, with branch roads in Peekskill, Cortland and York.

MUNICIPAL BONDS.

Bids are invited until Nov. 8, Talmage, Neb., for the purchase of water-works bonds.

Bids are invited at Norwood, O., until Nov. 22, for the purchase of $6,394.65 of 6 per cent. bonds.

Bids are invited until Nov. 7, Long Prairie, Minn., for the purchase of $10,000 6 per cent. bonds.

Sealed bids will be received at Tiffin, O., until Nov. 10, for the purchase of $8,000 of 6 per cent. bonds.

Sealed bids will be received at Arlington Heights, O., until Nov. 7, for the purchase of $6,000 of 6 per cent. bonds.

Bids are invited until Nov. 20, Aberdeen, S. D., for $20,000 refunding bonds, 6 per cent. 20 years, semi-annually.

Bids will be received until Nov. 5, at Madisonville, O., for the purchase of $6,025.60 of street improvement bonds.

Bids will be received until Nov. 30, Benson, Minn., for $4,500 bonds, 5 per cent. $1,000 in 2, 3, 4, and $1,500 in 5 years.

Improvement bonds are ready for sale at Peoria, Ill. Denominations, $100, $500 and $1,000 due in from one to six years, given by the City of Peoria, for improvements on Perry, Main and Adams streets.